OCTOBER 1953

NEW INDUSTRIES from Sprayed-On Plastics — Page 93

What YOU Should Know About PLASTICIZERS — Page 114

Now...a new and STRONGER MOLDING MATERIAL

...highest ever in high-impact phenolic!

Durez now offers you a phenolic plastic molding material having an impact or shock strength in foot-pounds per inch (Izod) ranging up to 27.

This compares favorably with some metals. It is several times as great as the impact strength of molding compounds in general use, the highest impact commercially practical in phenolics to date.

Fiberglas*, the strengthening agent, is used in a manner that conserves the industrially valuable properties of Durez molding phenolics.

Known as Durez 16221, the new material invites consideration for a large variety of applications. It has excellent dimensional stability, a high modulus of elasticity, good electrical properties and resistance to water, heat, and chemicals. It will withstand far higher service temperatures than cellulose-filled materials.

Fiberglas*-filled Durez 16221 is natural in color, comes in dry form, and is readily molded by standard compression methods. It produces parts or components having dependably uniform characteristics.

As specialists in phenolics for 32 years, we offer you the counsel of our field technical staff in investigating the profitable application of Durez 16221, which is now in commercial use.

*Owens-Corning Fiberglas

Want More Facts and Figures?

Send for folder DUREZ "16221 Natural"

DUREZ PLASTICS & CHEMICALS, INC.
1210 Walck Road, North Tonawanda, New York

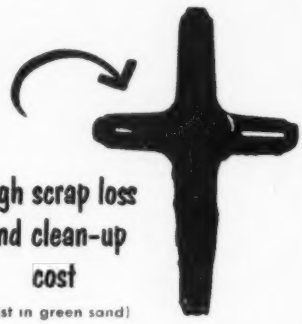
DUREZ

PHENOLIC RESINS

- MOLDING COMPOUNDS
- INDUSTRIAL RESINS
- PROTECTIVE COATING RESINS

PHENOLIC PLASTICS THAT FIT THE JOB

Keeping up on PHENOLIC RESINS



High scrap loss and clean-up cost
(cast in green sand)

Shell molding success with MAGNESIUM

Clean-up down, no scrap loss
(cast in shell molds)

Here's another field where Durez phenolic resins are playing a part in industrial progress. Using shell molds of sand and resin instead of the familiar green sand method, foundrymen now turn out smoother, more accurate castings in a variety of metals. Perhaps *your* business is facing a problem that resins can help in solving. As specialists in phenolics, Durez is ready to work with you.

count on DUREZ for PHENOLIC RESINS too

Displays molded of *Catalin Styrene* increase SPEIDEL Watch Band sales!

Braun-Crystal*, outstanding creator of point-of-purchase designs, selects the Gem of Plastics for
1. WINDOW DISPLAYS 2. GIFT PACKAGES 3. STOCK CABINETS

Whatever the molding requirement, it seems that CATALIN STYRENE is capable of doing it expressively well! We say that, because the Speidel "3 Point Plan" was no simple one-piece assignment. It involved the development of name-identified product attachment frames, multiple frame-holder displays and gift packages that doubled as individual presentation cases. It also included the creation of compact, customer-impressive stock cabinets . . . each to hold a quickly refillable, assorted inventory of 36 watch bands!

The solution, pictured above, as now hailed by both jeweler and public, is a tribute to the foresighted merchandising of Speidel, and a salute to the creative and productive planning of Braun-Crystal! Especially gratifying is the sense of satisfaction to be derived from the fact that CATALIN STYRENE, the gem of plastics, is acknowledged as having *materially* contributed to the success of Speidel's "3 Point Plan" *at all three of the three points!* With confidence, therefor, we commend CATALIN STYRENE to *your* attention!

**Designed and produced for SPEIDEL by Braun-Crystal Mfg. Co., Inc. 69-01 Metropolitan Ave., Middle Village, N.Y.*

CATALIN CORPORATION OF AMERICA
ONE PARK AVENUE • NEW YORK 16, N. Y.

CATALIN

In addition to Styrene Molding Compounds, Catalin chemical products include a wide range of Urea, Phenolic, Cresylic, Resorcinol, Melamine and Styrene Resin formulations.

MODERN PLASTICS*

OCTOBER 1953 VOL. 31, NO. 2

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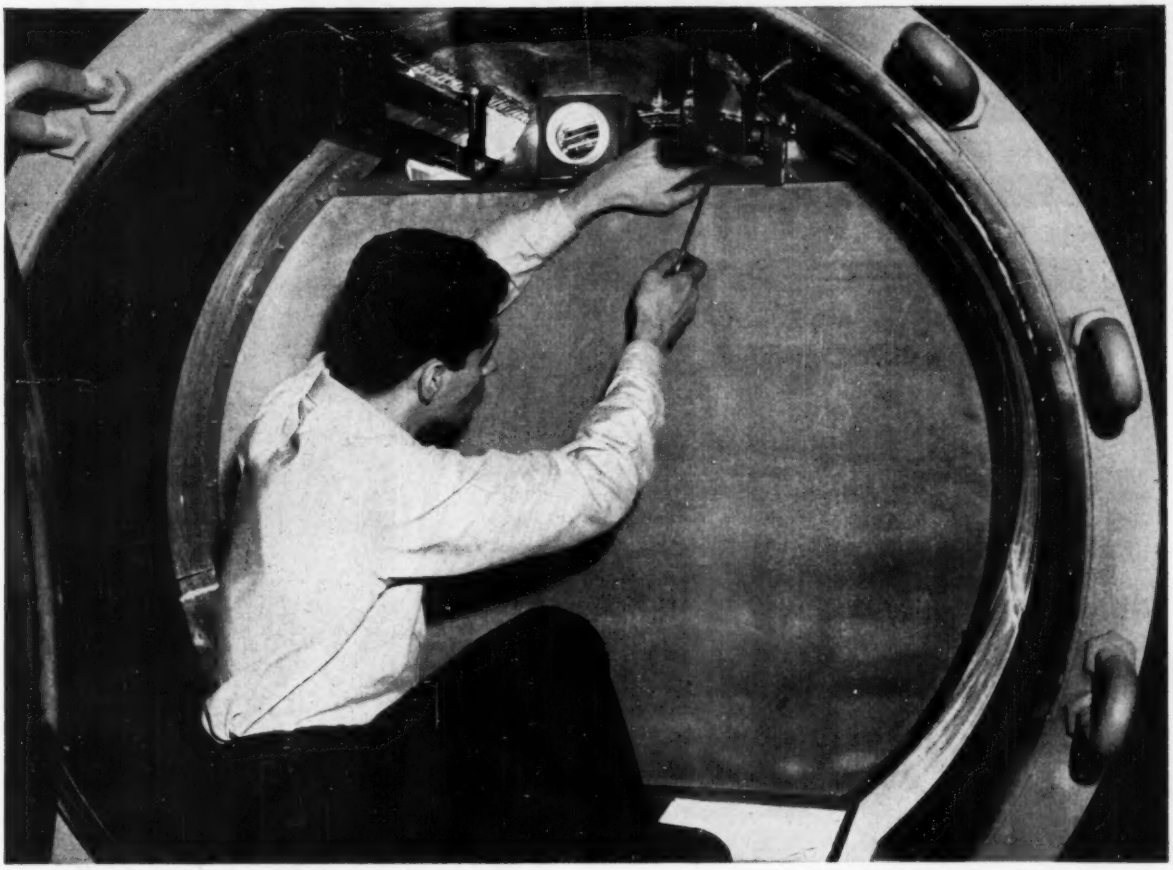
*Reg. U.S. Pat. Office

Another new development using

B. F. Goodrich Chemical *raw materials*



B. F. Goodrich Chemical Co. does not make this industrial filter. We supply the Geon vinyl resin only.

CORROSION-RESISTANT PLASTIC REPLACES METAL—COSTS 66% LESS!

HERE'S another new use for rigid Geon vinyl plastic—one that improved the product and saved money to boot!

Formerly, expensive metal alloys were used to make essential parts of the leaf-type, acid filter pictured. But these metal parts would be eaten by corrosion—some in a matter of hours. Costly replacements and lost time ran up expenses.

So the manufacturer tried a rigid Geon vinyl plastic. He found it not only had the required corrosion resistance, but cost 3 to 4 times *less* than special metal alloys. Now the filter leaf frames, nuts and bolts holding the leaves together, rollers holding the leaves in place, heel plate and various pipe fittings are all made from rigid Geon.

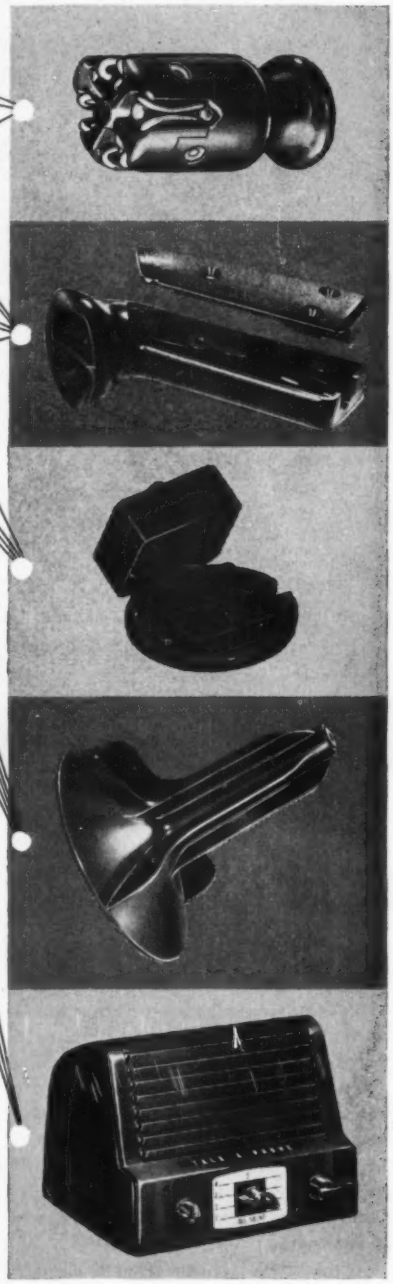
Versatile Geon vinyl materials have helped solve many problems. Products made from them can be either rigid or flexible, transparent or colored. And Geon resists acids, alkalies, most solvents and other chemicals, heat and cold. Let us help you select a Geon material suited to your needs—to help you improve or develop more saleable products. For technical information, please write Dept. GB-10, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

GEON RESINS • GOOD-RITE PLASTICIZERS . . . the ideal team to make products easier, better and more saleable.

GEON polyvinyl materials • HYCAR American rubber • GOOD-RITE chemicals and plasticizers • HARMON colors

What Combination *does your product call for ?*

- IMPACT STRENGTH
- STRUCTURAL STRENGTH
- HEAT RESISTANCE
- MOISTURE RESISTANCE
- ALKALI RESISTANCE
- ELECTRICAL INSULATION
- MINIMUM WEIGHT
- DIMENSIONAL STABILITY
- SMOOTH SURFACES
- LASTING FINISH



You may find the answer in

CHICAGO MOLDED *PHENOLICS*

Of course, no single material will give you all these qualities. But among the various formulations of phenolics and fillers are these important advantages, either singly or in combination. That's why this tried and proven material is still the most widely used of all plastics for hundreds of well-known applications.

The important thing is to know which of the dozens of phenolic formulations to use . . . and how to be certain of the desired results every time. And that's where we come in. We've been molding phenolics in all their widely varied forms for more than 34 years. We mold all other commercial plastic materials, too. So, all in all, we have accumulated a lot of valuable experience.

A surprisingly large number of the biggest names in industry have taken advantage of this experience . . . and, as a result, come to Chicago Molded year after year for the best in molded plastics. Most of them started by talking things over with a Chicago Molded engineer. You might find this a good idea, too. And there's no obligation whatsoever. Just drop us a line. Or, for fast action, wire or phone.

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EDITORIAL

A "Good Press" for Plastics

Infrequently the plastics industries and their industrial end users are irritated by reports and editorials in the daily press. When this does occur, the editors of MODERN PLASTICS receive scores of phone calls and letters suggesting that they find means of rebuttal or retaliation. Any such attempt would do little or no good. Editorial retractions or rebuttals seldom receive the same readership as the disputed article.

Actually, it is our opinion that relatively little harm is done by the printed ignorance of the daily press concerning plastics. And the attacks upon plastics are constantly becoming less frequent.

On the other hand, the plastics industries receive excellent treatment in the consumer magazine press—in publications covering the "shelter field" and in the women's service magazines, particularly. Well remembered, even today, is the superlative job done for plastics by the editors of *House Beautiful* six years ago this month. That publication, along with *Better Homes and Gardens, House and Garden, American Home, Good Housekeeping, Better Living,* and others have consistently reported fairly and objectively on domestic applications of plastics materials and on plastics products.

The editors of MODERN PLASTICS are regularly consulted by the editors of these publications and are always delighted to cooperate, because of the intellectual honesty and good intentions of these contemporaries. Latest example of consumer magazine leadership in developing public appreciation for better plastics materials and products is a four-page full-color feature in the September issue of *McCall's* magazine. *McCall's* literally built the interior of a small home, using plastics wherever practicable and tasteful. In one room, over one hundred different plastics applications were installed. The result is a beautiful and durable modern dwelling which could be reproduced on the open market at reasonable cost.

Not only are these consumer magazines (chiefly of interest to women) doing a magnificent editorial job on plastics; they are doing a promotional job. In the case of the *McCall's* story, the house will be exhibited at the National Home Show in New York and duplications of its contents will appear in department and furniture store window displays all over the country. Stores cooperating in the program will feature the plastics used by *McCall's* in local advertising and in radio and television broadcasts.

The total result of a feature such as this can make up in benefit to the plastics industries a million times the damage done by truculent, untutored, and uncreative newspaper hacks.

The Mystery of the Mottled Moldings

As Digby O'Casey, famous private eye, ankles his way along a shadowy street late at night, out of a doorway pops this luscious-shaped Angelcake blonde who slips her arm into his and holds tight. "Oh, Mr. O'Casey," she gurgles, "you've just gotta help ma' poor old Daddy. Those awful moldin's they're sendin' him, all mottled an' warped an' stuff. They'll just ruin his business. Please. You can help him. Can'tcha?"

O'Casey knows what to do in a spot like this. Firmly but gently he steers his new found friend to a nearby bar. A double bourbon calms her down. O'Casey whispers in her ear, "Phone your Daddy, Loveliness. Tell him to scamper down. I want to talk to him."

The clock barely turns a quarter-hour when Daddy arrives, rubbing the sleep-dust from his eyes.

He gasps, "You're O'Casey, the famous private eye, aren't you?"

"Right. You're Daddy?"

"Right. My daughter has an idea you can help me, but I know you can't. Nobody can. It's a conspiracy. I'll swear the Commies are behind it. Heaven help me. I'm sunk."

"Don't fret, Daddy, darlin'," Sugarpuss breaks in. "Mr. O'Casey's promised to find out why they send you such shoddy old moldin's." O'Casey shuts her up with a sharp rap across the kisser and a curt "Shut up, Lunkhead."

"When I take over," O'Casey says, "I get down to facts. Daddy, who's molding these moldings for you?"

"Some nincompoop named Piddlepooper. He says use six cavities costing $2,000 when I *know* he can do the job as well, and lots cheaper, in two for $500. And the idiot insists on bosses and fillets and ribs and junk like that. Of course, he's only trying to make a pile of dough out of me. But I'm on to him. You can bet a wad I turned thumbs down on his whacky ideas."

O'Casey's blood turns to water and freezes in his veins. He struggles to keep rein on himself. "Go on," he mutters.

"And to add insult to injury," Daddy continues, downing his brandy in a gulp, "this featherbrain has the gall to tell me my moldings call for virgin acetate. Any child can see reprocessed styrene is the thing."

O'Casey explodes like a loaded gas truck hitting a brick wall full speed. "Look you dumb dunderhead, Piddlepooper knows his stuff! If he says six cavities, it's six cavities. If he says ribs, it's ribs. If he says acetate, it's acetate and no questions about it. It gets me why he ever let you beat him down. There's no mystery to those mottled moldings," O'Casey roars on, "you beat his price down on the pieces and on the molds—you're getting just what you asked for."

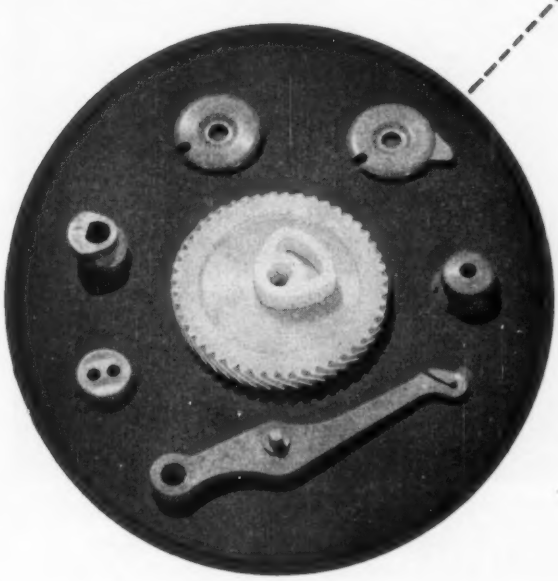
"Don't you snarl at my poor old Daddy, Mr. O'Casey," Honeychile whines.

O'Casey's mind snaps back to his personal affairs. He grabs her by the arm, whirls and heads for the door. "Going broke is too good for you, Daddy," he flings over his shoulder. "Wise up next time and take your custom molder's advice. He's got the right line on things. Now O'Casey and Baby have some unfinished business to take care of . . ."

* * *

If you pinned him down, O'Casey would certainly tell you that one molder known for serving up the straight dope and top quality work on custom injection and compression molding is Boonton Molding Company of Boonton, New Jersey. After thirty years in the biz, Boonton's got most of the right answers at their fingertips. And while they'll listen to reason, they won't let you stumble into your own mistakes. They won't be compromised. Boonton's New York office? It's at 122 East 42nd Street.

Parts of DU PONT NYLON need no oiling



Parts molded for the
Bell Manufacturing Corp.,
Freeland, Pa.,
by The Danielson Mfg. Co.,
Danielson, Conn., and
Consolidated Molded Products Corp.,
Scranton, Pa.

DU PONT
REG. U.S. PAT. OFF.
BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY
Polychemicals
DEPARTMENT
PLASTICS • CHEMICALS

Long-wearing sewing-machine parts promise 20 years' service

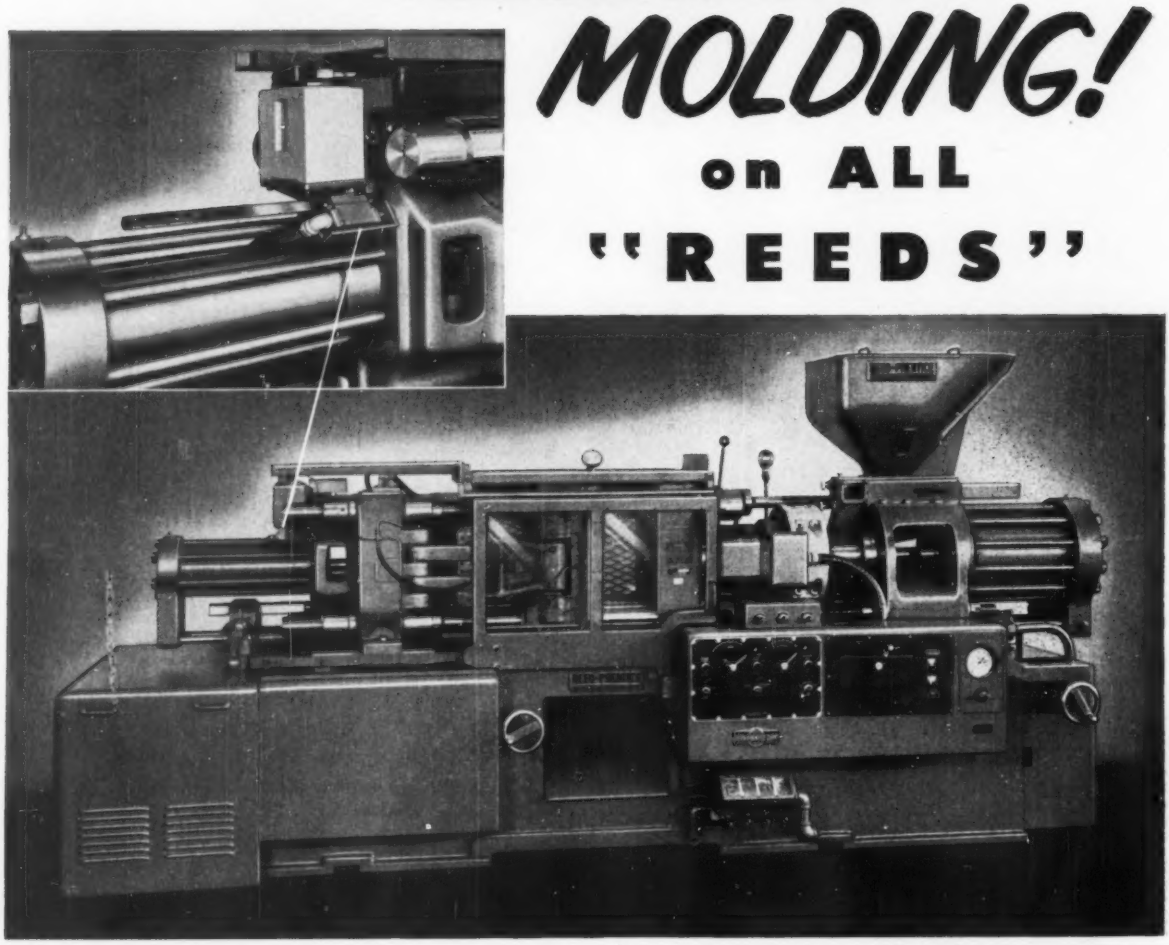
In designing a new, lightweight portable sewing machine, the Bell Manufacturing Corporation specified that the machine's key parts—gears, cams, arms, links, nuts and discs—be molded of Du Pont nylon. After extensive tests, Bell found in Du Pont nylon an engineering material that provides improved performance of these parts at low cost.

The camshaft gear, double-lobed feed cam and take-up arm link, all of tough, resilient nylon, have outstanding wearing qualities (they were still in good operating condition after a wear test equivalent to twenty years' use). Molded Du Pont nylon has a low coefficient of friction, so these parts never need oiling, yet operate noiselessly. The nylon thread take-up arm and tension discs stand up to punishing movement without cracking, chipping or bending out of shape. The smooth surface of molded Du Pont nylon never snags thread. These parts are injection-molded in one rapid operation, cutting production costs more than 80%. And because of nylon's low specific gravity (1.14), total weight of the machine has been reduced by a quarter pound.

Molded Du Pont nylon today is contributing to many design and operating improvements. Perhaps its unique combination of mechanical, electrical and other properties can help you improve or develop a product. For further information, write: E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Department, Room 3010, Du Pont Bldg., Wilmington 98, Delaware.

FULLY AUTOMATIC MOLDING!

on ALL "REEDS"



10D-8 oz. "REED" with Low Pressure Die Closing Unit (Toggle cover removed)

Fast, fully automatic injection molding with complete safety is easily obtained on Reed-Prentice machines through a low pressure die closing attachment.

This unit permits rapid, continuous molding of plastic parts adapted to automatic production. It effectively prevents damage to dies and allows one man to tend two or three machines.

A flashing signal attracts immediate attention if a piece should fail to eject properly. In such event, the machine stops instantly to prevent any mold damage.

Low pressure die closing units can be applied to "REEDS" now in use or furnished as extra equipment on new machines.

"REEDS" available in 4, 8, 12, 16, 20, 24, 32, 48 and 200 oz. capacities

"REEDS"—the World's Foremost Machines for EXTRA CAPACITY MOLDING

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FULLER BRUSH QUALITY
demands
Acetate HANDLES AND BACKS

There's more to a good brush than the bristles. Handsome, durable brush blocks and handles contribute to the Fuller reputation. And along with other quality brush companies, Fuller molds many parts of Celanese* acetate for:

- **dimensional stability and bristle retention**
- **moldability in strong, detailed cross sections**
- **no crazing in drilling or machining**
- **tough chip-proof surface . . . touch comfortable**
- **resistance to hot water, hair oils and dressings**
- **wide selection of colors and special effects**

If you're making a personal use item, appliance, toy, or housing, keep up to date with Celanese acetate. You'll appreciate its economy...you can build business on its dependability. Celanese Corporation of America, Sheet and Molding Compound Department 101-J, 290 Ferry Street, Newark 5, New Jersey.

Canadian affiliate, Canadian Chemical Company, Ltd., Montreal and Toronto.

Celanese®
Acetate MOLDING MATERIALS

*Reg. U. S. Pat. Off.

Don't you wish *you could say these things about your presses and your power source?*

"We operate seventeen modern downstroking compression presses in the identical space formerly occupied by 11 *obsolete* presses."

"Once we set a cycle, no matter how complex it may be, it is reproduced exactly, at just the push of a button."

"Within two-and-a-half seconds, our presses can close, apply 60-tons clamping pressure, and start to transfer the material."

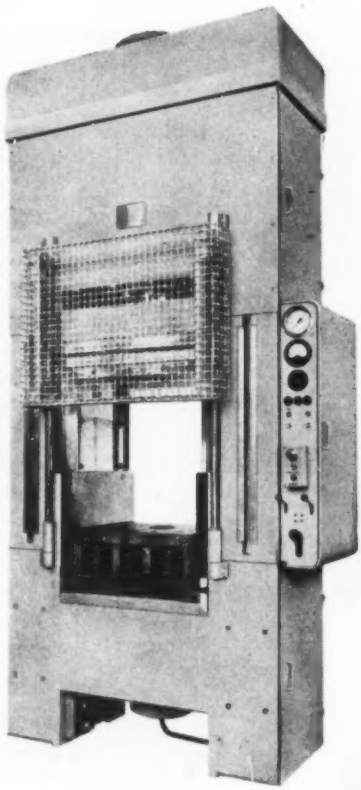
"We have one inexpensive, *flexible* power source which gives us a choice of three working pressures per press."

"In over twelve months' operation, we have never had a breakdown in our medium-pressure-plus-intensifier system that caused a production stoppage of more than ten minutes . . . And few of those."

"Thanks to the fast cycling of our presses and their low reject rate, our production is up almost 15%."

"Our eighteen 150-ton presses operate continuously with cures ranging from 35 seconds to 2 minutes. Yet, a double pump unit with one 10 and one 15 h.p. motor supplies all the power we can use."

You can *if you install Bipel "auto-control" presses and central power units.*



Wherever Bipel presses and power units have been installed, they have established new *higher* standards for fine compression and transfer molding. The Bipel Type 40 press operates at 20, 40, or 60 tons pressure; the Type 100, at 50, 100, or 150 tons; the Type 200, at 100, 200, or 300 tons.

Being complete molding machines, compactly built, better designed and engineered in every detail, they produce consistently *superior* moldings than conventional four-column presses.

The unique Bipel drive system avoids high pressure until the hydraulic fluid is in the press. Therefore, the pumps require less horsepower, the piping needs less thickness, and the valves and other components are lighter and less expensive to purchase, to install, and to operate.

We are certain that additional details will further prove the ability of Bipel presses and power drives to increase your profits significantly. Your request will be answered promptly.

B·I·P GROUP

B.I.P. ENGINEERING LTD.

Aldridge Road, Streetly, Staffordshire, England

Information Round-up

on

TRADE-MARKING
IDENTIFICATION
DECORATION

Get the facts about Swift Nu-Hue and Dri-Hue. This 16-page illustrated booklet tells the whole story about these specialized color foils. Contains everything you need to know about application . . . equipment . . . operating temperatures . . . plus Swift *free* Laboratory Service. Evaluate the advantages of this Swift color branding process yourself . . .

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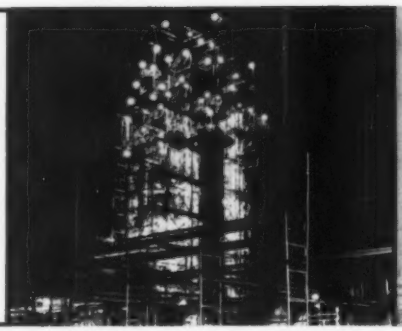
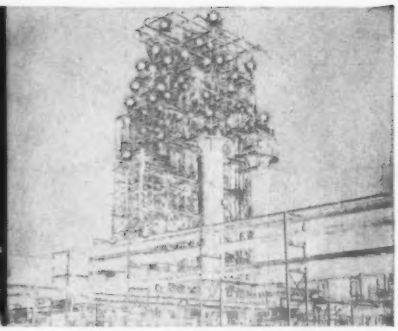
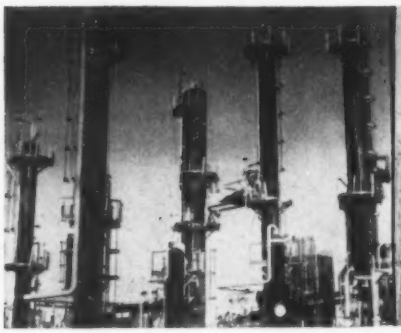
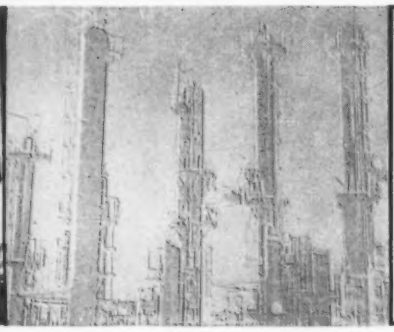








STYRENE
ACRYLONITRILE
VINYL CHLORIDE

Starting Points for New, Profitable Products

If you are equipped for product research, explore Monsanto's monomers for new product development.

These low-cost reactive compounds are readily available for the development of scores of new products or product improvements.

EXAMPLE: Ask yourself: "What could styrene do for asphalt?"—Styrene is a powerful solvent and aided by catalysts will polymerize in a variety of mixtures. Styrene in roofing or paving compositions will act as a solvent, permitting cold mixes . . . then with suitable catalysts the mixture may polymerize in place into a longer-wearing composition. If you use or process asphalt compositions, here's a possibility worth exploring.

This is only one idea . . . there are dozens more suited to your own special field. Monsanto's monomers can be your starting points for new copolymer resins, special coatings and extrusion compounds. They can act as short cuts to organic syntheses. Try Monsanto monomers yourself by writing for laboratory samples. For more information on these products, write **MONSANTO CHEMICAL COMPANY, TEXAS DIVISION, TEXAS CITY, TEXAS.**

OTHER TEXAS DIVISION ADVANTAGES:

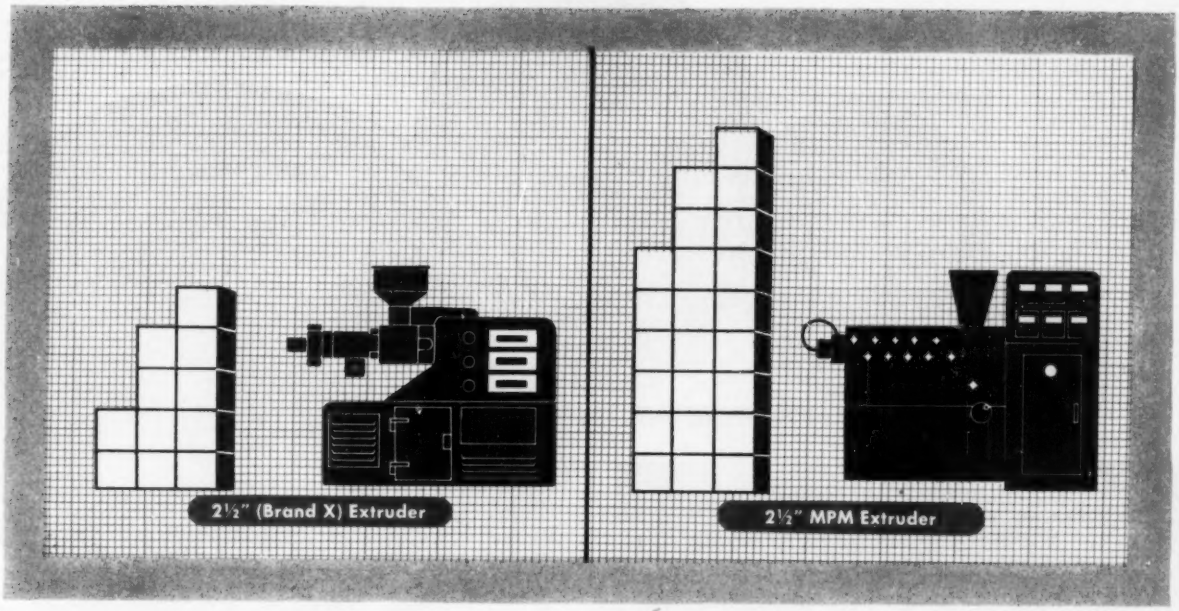
TOP QUALITY . . . *all monomers are higher purity, produced in industry's most modern plants, under strict quality control.*

"TIMED SHIPMENTS" . . . *deliveries synchronized with your production from five strategically located shipping points. This system can release valuable tank storage space for other use.*

TECHNICAL SERVICE . . . *on storing, handling, inhibiting, analytical procedures, specifications.*

MONSANTO
CHEMICALS AND PLASTICS

SERVING INDUSTRY...WHICH SERVES MANKIND



Can you afford to overlook mpm's dollars and cents payoff?

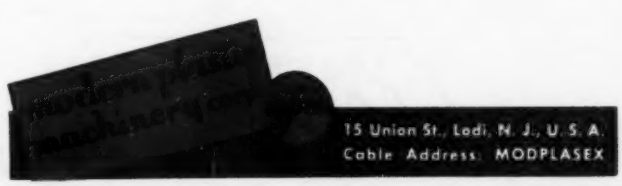
On one installation after another MPM extruders have out-produced competitive equipment when covering wire or cable, or extruding roll-flat tubing, flat sheet, rods, strips, tubes, and the like from a wide variety of compounds. The tonnage of material shipped is the best yardstick for evaluation.

The widespread preference for MPM extrusion machines is a direct outgrowth of productive capacity, less down-time, and of the fact that MPM can usually be of greatest assistance in recommending dies, accessories and plant layouts, for producing specific sections.

In many cases, we ask customers to see their equipment test-run before shipment, to familiarize them with speeds, temperatures, and other operational data. The equipment is furnished complete, requiring only connection with water and electric lines as a rule.

In addition to extruders, MPM supplies every type of extrusion production equipment you might need. Capstans for wire covering. Orienting units for monofilaments. Conveyors for rod, tube and belting. Pull-offs for pipe. Pinch rolls and take-ups for film. Dies for the extrusion of any given cross section.

Write today; tell us what you want to extrude. We will recommend MPM equipment to do the job . . . equipment which gives you *greater productive capacity* per dollar of purchase price than any other.



(West Coast Representative)
4113 W. Jefferson St., Los Angeles 16, Calif.

After molding, the Tenite 2(MH Grade) reflector shells are given a lacquer undercoat and placed in a CVC 48 inch horizontal coater (Model LC1-48A). In less than half an hour, they are metallized and ready for another coating of lacquer. (Reliance Varnish Company supplied the undercoat and topcoat lacquers used).

As with all CVC vacuum coating units, this one comes equipped with all necessary controls, is easy to operate, requires little maintenance.

a CVC vacuum coater puts the gleam on a butyrate flash reflector

Most plastics are easy to vacuum metallize. But not all grades of butyrate.

Yet, just recently Eastman Kodak Company set up production of a vacuum metallized butyrate flash reflector using *CVC* equipment. This new development was made possible by using *CVC's* technical knowledge and practical experience in the development program by Eastman Kodak Company.

The result is a reflector with higher reflectivity and better appearance than previous metal models. And, the coating is tough enough to withstand all normal handling.

CVC's experience in high vacuum metallizing and associated lacquering operations is available to help solve your problems. And *CVC* is ready to help you get started in this rapidly growing business with the most efficient vacuum metallization equipment available. For information on this or any other application of high vacuum, write to ***Consolidated Vacuum Corporation, Rochester 3, N. Y.*** (A subsidiary of Consolidated Engineering Corporation, Pasadena, Calif.) Sales offices: Menlo Park, Calif. • Chicago, Ill. • Camden, N. J. • New York, N. Y.

CVC

formerly DPi Vacuum Equipment Dept.

Consolidated Vacuum Corporation

Rochester 3, N. Y.

high vacuum research and engineering

Postformed Laminates–

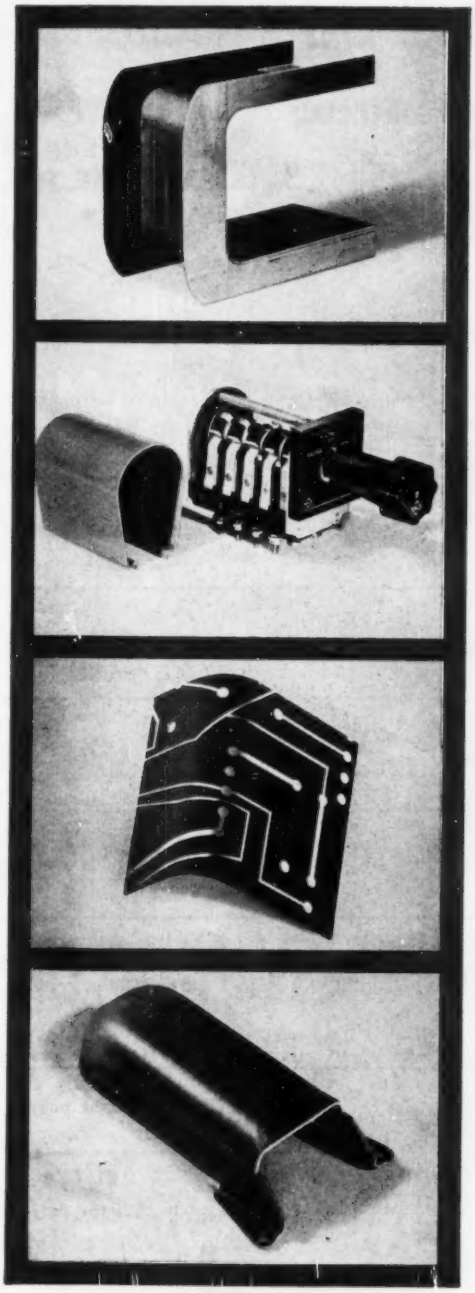
for shaping new ideas and cutting costs

Your use of postformed plastic laminates can bring about substantial manufacturing economies. This is particularly true if your product has irregular contours that usually require expensive molds or dies for fabrication.

Postforming grades of plastic laminates are supplied as flat sheets, paper or fabric base. These laminates are made with special types of BAKELITE Phenolic Resins developed expressly for postforming. The sheets are first cut to size by sawing or shearing, or with steel blanking dies. Then they are reshaped by rapidly bringing them to a high heat, quickly bending or drawing them to the desired form, and holding them in position until cooled and rehardened into final form. Simple jigs and fixtures of wood, metal, or plastic are used. Postformed pieces can be readily machined with standard tools.

Postformed laminates are lighter than metal. They won't dent easily. They have good electrical insulating properties, as well as chemical and abrasion resistance. They make an excellent insulating chassis for electrical, telephone, and radio equipment, because parts can be mounted on them directly, without using insulating pieces.

Similar manufacturing and sales advantages for your product may come from the use of postformed laminates made with BAKELITE *Phenolic Resins. Write Dept. RZ-13. for names of laminators who supply plastic postforming materials.*



This gap insulator made of postformed laminates demonstrates the formability of these materials. Toughness is an important feature.

Electrical and mechanical properties are combined with formability in this control switch barrier made of a postformed laminate.

Printed circuits like this, based on postformed laminates, need not be restricted to flat surfaces.

Even intricate, detailed shapes like this instrument cowling can be achieved with postformed laminates.

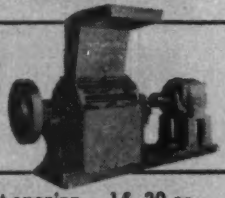
BAKELITE
TRADE-MARK
PHENOLIC LAMINATING RESINS

TRADE MARK

BAKELITE COMPANY
A Division of
Union Carbide and Carbon Corporation
UCC
30 East 42nd Street, New York 17, N. Y.
In Canada:
Bakelite Company (Canada) Ltd., Belleville, Ont.

how to pick the right granulator for your needs

IF YOUR MATERIAL IS LIKE THIS	AND YOUR CAPACITY NEEDS ARE LIKE THIS	B&J YOU NEED THIS GRANULATOR
Gates, sprues, runners, rejects, etc., from ⅛" to ½" sectional thickness	up to 75 lbs. per hour	**MIDGET**—5½" x 6" throat opening —1 HP motor—2 models, with bin, or to granulate directly into a drum —18" x 22" floor space
Large sprues and runners, and small rejects	up to 150 lbs. per hour	**LABORATORY 251** — 8" x 8" throat opening — 1½ or 2 HP motor — granulates directly into a drum or bin
Accumulated average scrap—large sprues, runners, medium area rejects	up to 250 lbs. per hour	**STANDARD IDEAL**—3½" x 10" throat opening —2 or 3 HP motor—Model 301 has 6" x 10" throat opening
Accumulated scrap of tough dense materials and small bleeder scrap	up to 250 lbs. per hour	**HEAVY DUTY IDEAL**—3½" x 10" throat opening—5 HP motor—Model 351 has 6" x 10" throat opening
Tough scrap, purges or rejects and large area scrap	up to 500 lbs. per hour	**No. ½ HD**—8" x 20" throat opening—15 HP motor—features breaker knife at top of cheek piece. This is our sturdiest medium size machine.
Accumulated runners, sprues, tough scrap, purges, etc.	up to 750 lbs. per hour	**No. 1** — 7" x 24" throat opening — 10 or 15 HP motor
Tough scrap, purges, lumps, virgin slabs, etc.	up to 1200 lbs. per hour	**No. 1½** — 8" x 26" throat opening — 15, 20 or 25 HP motor
Virgin slabs, large lumps, purges and large rejects	up to 1800 lbs. per hour	**No. 2** — 3 models — 28"x10", —18"x10" or — 12"x10" throat openings — 25 to 60 HP motor



This is a partial listing of our extensive line — there are additional models to meet every requirement. Tell us your requirements and send samples of your material for grinding in our testing laboratory. After thorough test grinding and analysis we will recommend the machine best suited for your purpose.

BALL & JEWELL, INC.

Leaders in Granulating Machinery for a Half Century

22 FRANKLIN STREET EVergreen 9-6580 BROOKLYN 22, NEW YORK

thermosetting plastics a *Question* Mark to you?

HERE'S A WELL-KNOWN *Answer* Mark!

It's a mould mark—ours. And it's a sign of good source for thousands of manufacturers who use moulded plastic parts.

Here are our qualifications for *your* thermosetting assignments: 1) 36 years' *experience* as planners and moulders in plastics; 2) *specialization* in thermosetting standard materials or new ones like Teflon and glass reinforced moulding compounds; 3) enviable skill in *design* for compression, transfer and plunger moulding methods; 4) *capacity* for production-schedule delivery.

There's a fifth qualification we think is worth mentioning. We're not too proud to recommend specialists in *other* moulding methods if a review of your job suggests it. Will you phone or write us—or one of our offices?

Kurz-Kasch, Inc. • 1415 S. Broadway • Dayton 1, Ohio

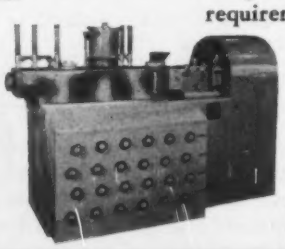
BRANCH SALES OFFICES: New York, Lexington, 2-6677 • Rochester, Hillside 4352 • Chicago, Merrimac 7-1830 • Detroit, Trinity 3-7050 • Philadelphia, Hilltop 6-6472 • Dallas, Logan 1970 • Los Angeles, Richmond 7-5384 • St. Louis, Delmar 9577 • Toronto, Elgin 4167
EXPORT OFFICE: 89 Broad Street, New York City, Bowling Green 9-7751.

Kurz-Kasch
FOR OVER 36 YEARS PLANNERS AND MOULDERS IN PLASTICS

BIG SCALE CAPACITY

HOW OBVIOUS it is that Nature favored Mr. Hippo with abundant INTAKE capacity! He operates on a big scale. In comparison, the intake on Welding Engineers' Compounder-Extractor-Extruders is just as efficiently designed . . . from the engineering viewpoint. And it's on a big scale too . . . for this equipment has a "ravenous appetite." The hopper openings are really BIG to take plastic feed of all kinds in full stride for perfect teamwork with Welding Engineers' patented dual worm compounding action that out-performs machines of any other design in the field. Capacity means: Profits, Lower Labor Costs, Better Delivery Schedules!

TAKE A LOOK at the "Mr. Hippo" in the world of compounding, extracting, and extruding of plastics and you'll be tracking down a machine with a record of trouble-free, one-operation performance day in and day out for the leaders, *the BIG names in processing. They took time to take a good look and it paid off for them. It can pay off for you.*



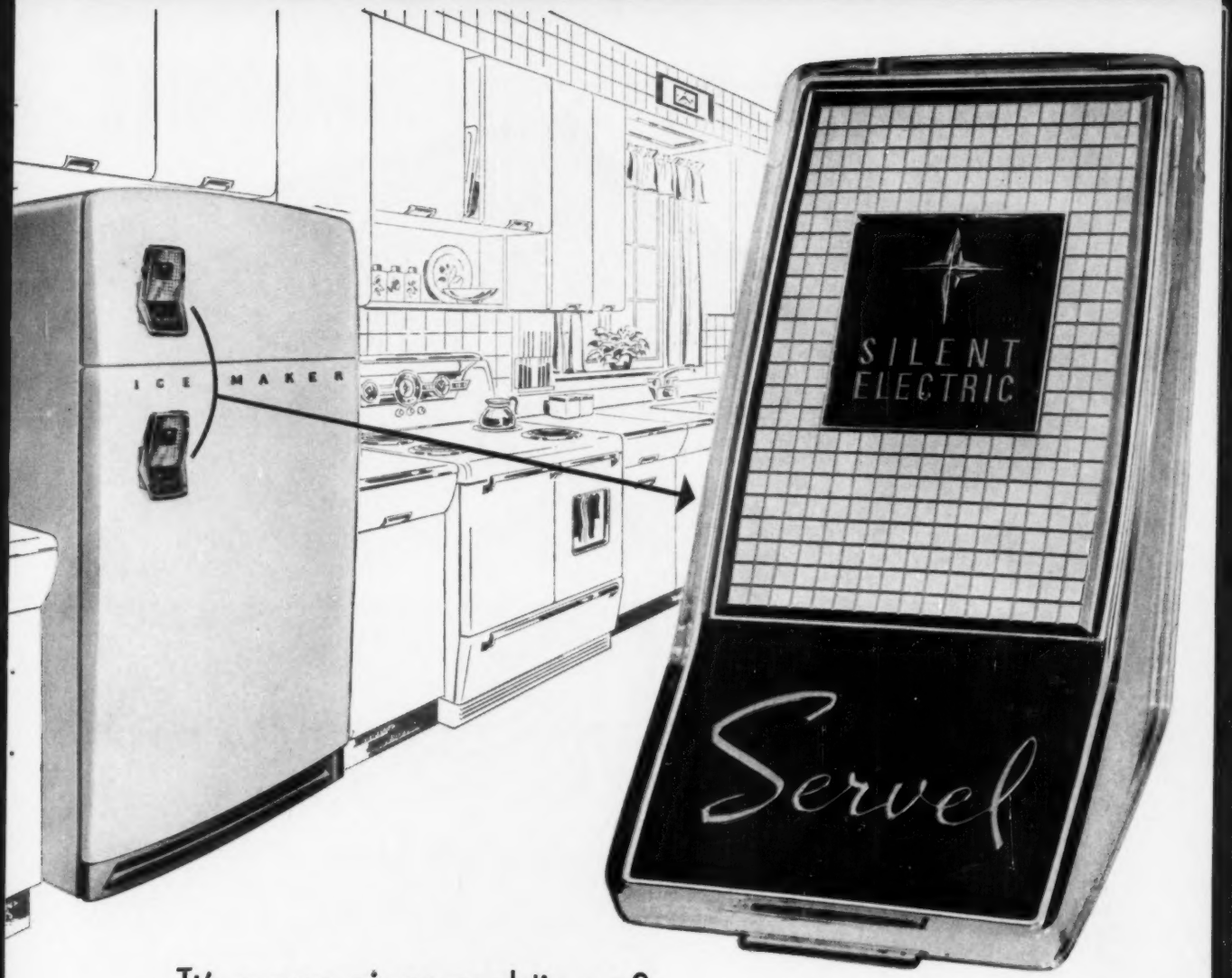
WELDING ENGINEERS' COMPOUNDERS-EXTRACTORS-EXTRUDERS are custom-fitted to your particular needs. The almost limitless combinations in dual worms of our unique design make it easy to provide the EXACT machine for your EXACT requirements. No matter how tough the production assignment, you'll find this equipment economical and efficient . . . dependable . . . and a good investment. This is no loosely spoken claim: performance from laboratory to production lines substantiate it. May we have the opportunity of discussing your particular Compounding-Extracting-Extruding problems with you?

WRITE for the complete story of the Welding Engineers line, sizes, capacities, specifications — TODAY.

WELDING ENGINEERS, INC.

NORRISTOWN, PENNSYLVANIA

PIONEER MANUFACTURERS OF EQUIPMENT FOR THE PLASTICS, RUBBER AND PETROLEUM INDUSTRIES



...It's a one-piece molding of **PLEXIGLAS**

New Servel "Automatic Ice-Maker" gas and electric refrigerators feature handles that can be operated by wrist or elbow. Colorful handle-facings, 7½" x 4" x 1½", are molded of PLEXIGLAS V-100.

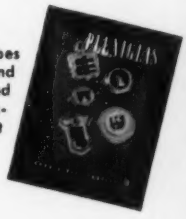
The handsome face of this refrigerator handle is not an assembly of separate parts. The raised edges, the sides, lettering, markings, and background areas are all part of the same single molding—of PLEXIGLAS acrylic plastic.

The molding is transparent—metallized and spray painted on the rear surface to produce the brilliant chrome bezel effect, the mirrored and richly colored backgrounds, the gleaming letters and decorations.

In addition to eye-catching appearance, the part has excellent serviceability. Because it is molded of PLEXIGLAS, its crystal clarity does not change with age . . . and it has the strength and stability to withstand hard knocks, sudden shocks, moisture, and constant handling.

The chances are that parts molded of PLEXIGLAS can add durable sales appeal to the product *you* are designing or manufacturing, too. We will be glad to tell you how this acrylic plastic, so widely used in many fields, can meet your specific requirements.

This booklet, "PLEXIGLAS Molding Powders", describes the properties and advantages of PLEXIGLAS and shows how it is being used for molded parts and extruded sections in outdoor and indoor applications. Write to the Plastics Department for it today. You will receive it promptly.



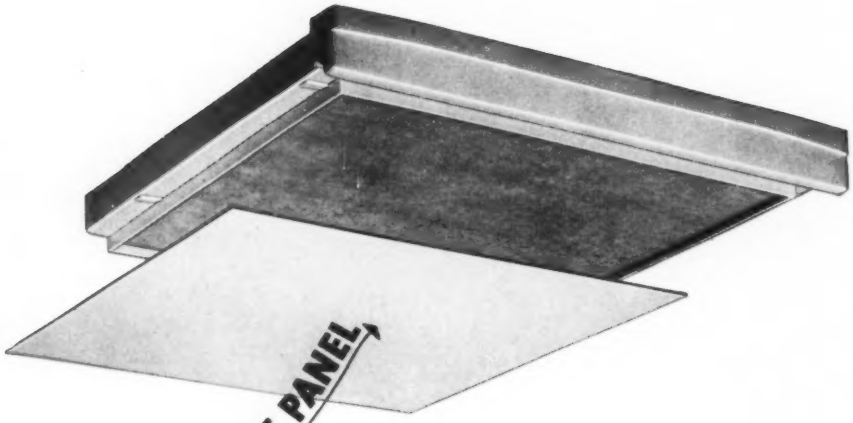
CHEMICALS FOR INDUSTRY

ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA 5, PA.

Representatives in principal foreign countries

PLEXIGLAS *molding powders are listed in Sweet's product Design File, Section 1c/Ro.*
PLEXIGLAS *is a trade-mark, Reg. U. S. Pat. Off. and in principal countries of the western hemisphere*
Canadian Distributor: *Crystal Glass & Plastics, Ltd., 130 Queen's Quay at Jarvis Street, Toronto, Ontario, Canada*



POLYFLEX® SHEET REPLACES MOLDED STYRENE PANEL

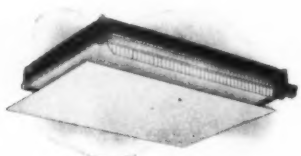
SAVES 55¢ PER UNIT

problem: Original specifications for a Westinghouse refrigerator baffle assembly called for a bottom panel .100" thick. Normal procedure would be to mold the assembly in two parts in order to get the desired thin panel in the bottom section. Estimated cost for the molded bottom section was 75 cents.

solution: In replacing this section with Polyflex, an oriented polystyrene sheet, the molder provided a tough, thin panel for only 20 cents. High strength of Polyflex permitted use of only .020" gauge, which reduced weight.

advantages: Ability of Polyflex to conform closely to the contours of the other section provided a more leak-proof assembly. In addition, Polyflex will not warp, twist or shrink in refrigerator temperatures. Water absorption is nil.

Tough, versatile Polyflex is doing things no other sheet plastic can do. Why not write us for complete information?



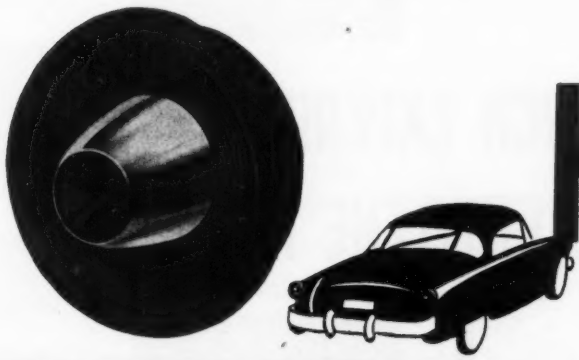
NOSCO PLASTICS, *division of National Organ Supply Co., Erie, Pa., is the molder who worked out this Polyflex application.*

PLAX

PLAX CORPORATION

WEST HARTFORD 1, CONNECTICUT

STIMSONITE* . . . Leaders in Precision Acrylic Molding . . . Choose H-P-Ms!

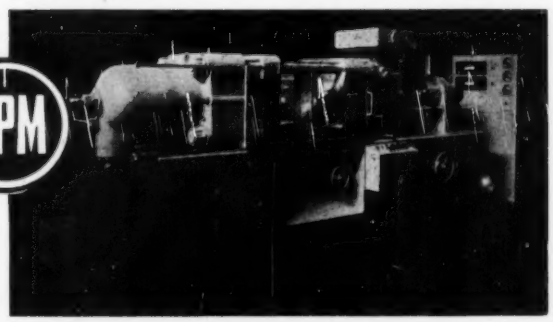


*Trade Mark of the A. G. A. Division of the Elastic Stop Nut Corp. of America, Elizabeth, N. J.

Molding acrylic automobile tail-light lenses such as that of the 1953 Ford illustrated, incorporating the famous Stimsonite reflector, is another big production job handled 100% with H-P-M injection machines.

Close-up at left shows a typical big job handled by Stimsonite on one of their 16-oz. machines . . . a 17-oz. shot with a projected area of 84 square inches. Here's precision molding at its best!

Regardless of your molding application, whether it be acrylic, polystyrene or any other thermoplastic, you'll handle the job better and faster with an H-P-M. Investigate, now, how an H-P-M will help your production. Write for Bulletin 5204 today!

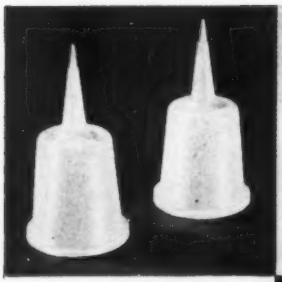


This new 16-oz. machine for Stimsonite brings their H-P-M total to 9 machines with a 32-oz. on order.

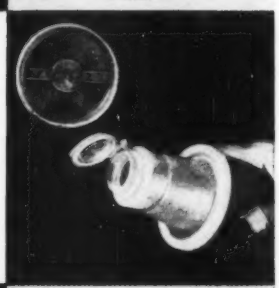
THE HYDRAULIC PRESS MFG. CO.

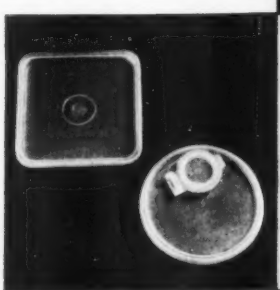
1010 Marion Road, Mount Gilead, Ohio, U.S.A.

Presses For Every Pressure Processing Application



NOBODY HAS AS MUCH EXPERIENCE AT MOLDING POLYETHYLENE AS TUPPER!





Tupper Seals are air and liquid-tight flexible covers. The famous Pour All and Par Top covers are designed for easy dispensing. They are made in sizes to fit all Tupperware containers.

The logical molder for you to consult regarding that product or package of yours which is to be made of polyethylene is Tupper. Tupper has done more than any other molder to make molded polyethylene a practical reality.

Aside from having designed, patented, and promoted successful seals, closures, and dispensers for polyethylene containers, the Tupper Corporation has vast experience in *every phase* of polyethylene packaging and polyethylene injection molding. This experience will be of major importance in improving your product, in reducing your costs, when Tupper goes to work for you.

Tupper's combination of experience, technical ingenuity, and the most modern equipment is at your service for the custom molding of your product in polyethylene. You can do no better than the best ...and the best at molding polyethylene is Tupper!

When equipped with Tupper Seals, Tupper Canisters, Sauce Dishes, Wonder Bowls, Cereal Bowls and Funnels in various sizes are the most versatile reusable containers you have ever seen.

TUPPER!
TRADE MARK

TUPPER PRODUCTS ARE FULLY PROTECTED

About 150 United States and foreign patents and patents applied for, plus numerous trademarks and copyrights, cover the design and manufacture of the various types of Tupper Seals and other Tupper Products. Unauthorized manufacture of items covered by Tupper patents will subject infringers to prosecution.

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Manufacturers of — CONSUMER, INDUSTRIAL, PACKAGING AND SCIENTIFIC PRODUCTS

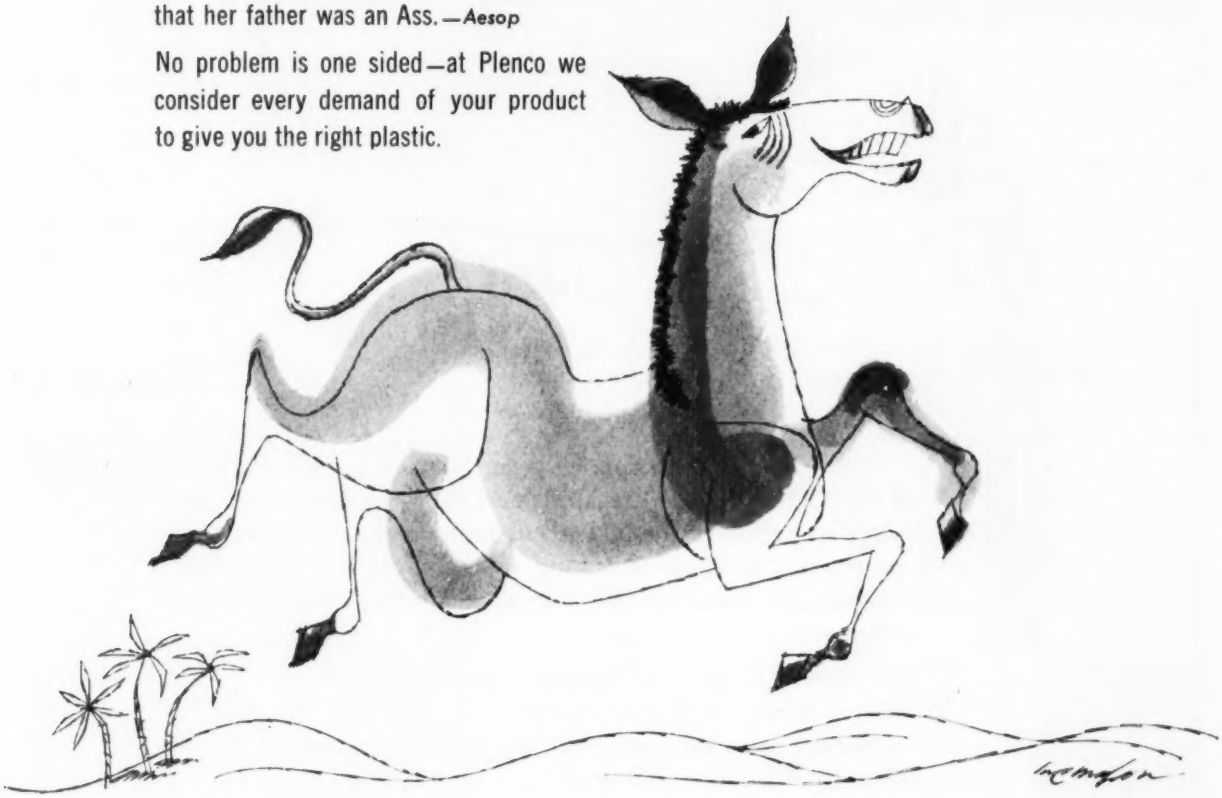
Factories, Laboratories and Sales Offices:
Farmumsville, Mass., Orlando, Fla., L'Epiphanie, P.Q.
Showrooms: 225 Fifth Ave., N. Y. C.

Address All Communications To:
DEPARTMENT M-10.

The Mule

A Mule grown fat and wanton on too great an allowance of corn was one day jumping and kicking about. Cocking her tail, she exclaimed, "My mother was a Racer and I am quite as good as ever she was." But, being soon knocked out with her galloping and frisking, she remembered that her father was an Ass.—*Aesop*

No problem is one sided—at Plenco we consider every demand of your product to give you the right plastic.



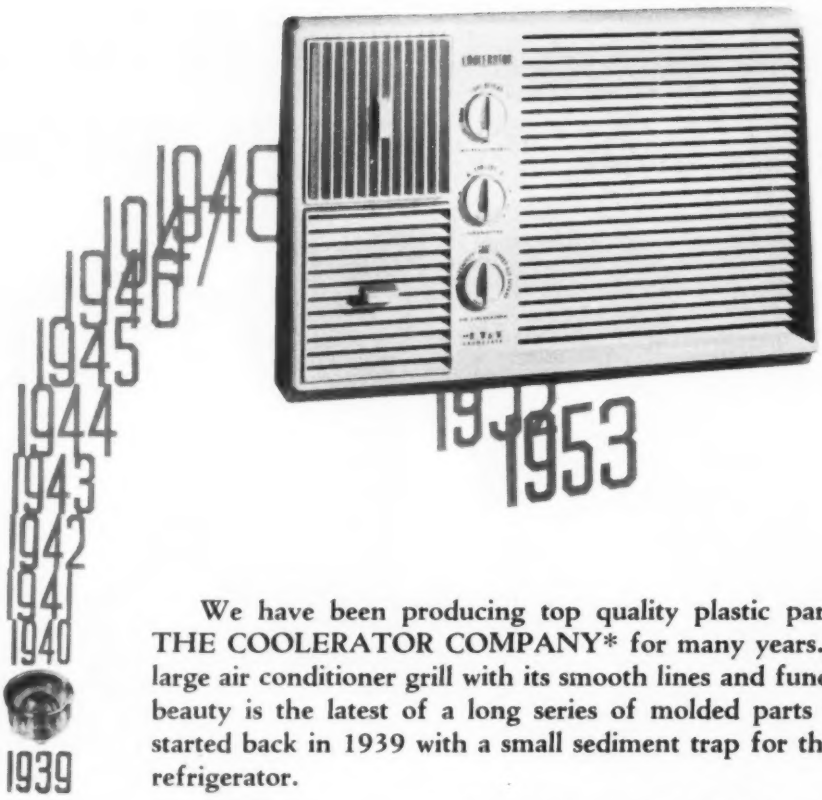
PLENCO PLASTICS

FOR BETTER PLASTIC PRODUCTS

PLASTICS ENGINEERING COMPANY

Sheboygan, Wisconsin

ANOTHER OUTSTANDING PRODUCT



We have been producing top quality plastic parts for THE COOLERATOR COMPANY* for many years. This large air conditioner grill with its smooth lines and functional beauty is the latest of a long series of molded parts which started back in 1939 with a small sediment trap for their ice refrigerator.

By combining our facilities and technical skill with a policy of producing only the FINEST in injection molding, we maintain for our customers the high standards of quality that their products deserve.

Write for our facilities booklet.

*Coolerator
IT&T DIVISION

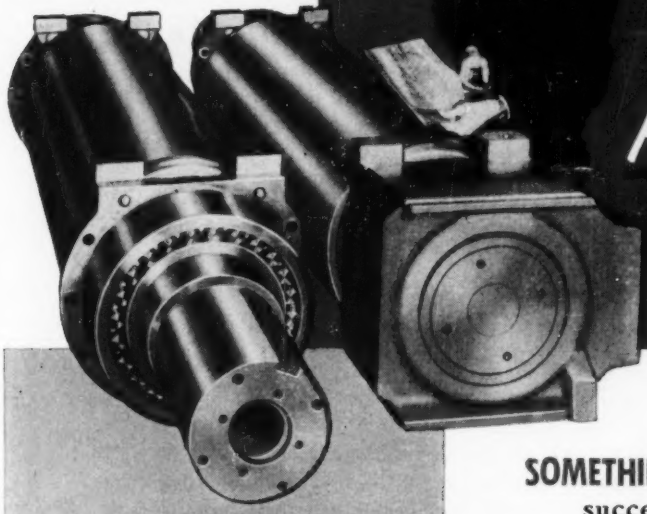
Minco

MINNESOTA PLASTICS CORPORATION

INJECTION MOLDERS OF THERMOPLASTICS

GARFIELD 5368 • 366 WACOUTA ST., ST. PAUL 1, MINNESOTA • NESTOR 3144

Anti-Friction Mill Roll Bearings



ADAMSON Roller-Bearing PLASTICS MILLS

Fifteen years ago, it was realized by pioneer plastics manufacturers, that the problem of stock contamination and high temperatures must be solved. Recognizing these problems, this type mill was developed with the aid of the B. F. Goodrich Company and the SKF Bearing Company. Many improvements have been made by those contributing to the original design, but today, the basic design remains practically the same. *Every pound of Koroseal* material requiring the use of mills is processed on Adamson Roller-Bearing Mills.*

Write us for complete mechanical and production data.

SOMETHING NEW? NO! In continuous and successful operation since 1938.

WHERE? IN ALL B. F. GOODRICH PLANTS where *Koroseal** material is processed.

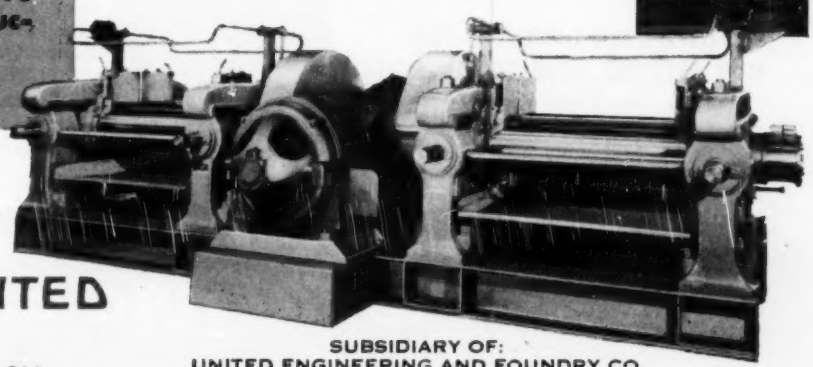
WHY? Because of their ABSOLUTE CLEANLINESS . . . Freedom from Contamination . . . Low Maintenance where High Temperatures are Necessary.

HOW? By use of SKF ROLLER BEARINGS WITH SPECIAL PISTON RING SEALS . . . Tilting Stock Guides . . . Removable Stainless Steel Stock Pans, and other Special ADAMSON Features.

*REGISTERED TRADE MARK OF B. F. GOODRICH COMPANY

Close-up of Swinging Stock Guide ▶

22 x 60 Twin Mill Unit with Roller Bearings ▼



ADAMSON UNITED COMPANY

730 Carroll Street, Akron 4, Ohio

SALES OFFICES IN PRINCIPAL CITIES

SUBSIDIARY OF:
UNITED ENGINEERING AND FOUNDRY CO.
PLANTS AT:
PITTSBURGH • VANDERGRIFT • NEW CASTLE
YOUNGSTOWN • CANTON

ELMES HYDRAULIC PRESSES

are setting records in

Big-Profit Plastics Molding

In scores of plastics molding plants, ELMES Presses are proving daily *by performance* that there is no real substitute for the ELMES Engineering Staff's century-long hydraulics background and problem-saving ingenuity in modern press design.

Invariably, when an ELMES Press goes into operation, the customer gets exactly what our engineers have *planned* for him:

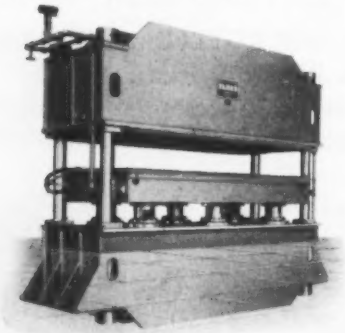
Top speed, accurate production.
Full push-button controls: for step-by-step or automatic-time-cycle operation.
Simplified design, for low-cost minimum maintenance.
Better work . . . longer runs . . . bigger profits!

Your plastics molding needs may be such that the ideal press to meet them has already been planned, and is now available as one of the ELMES *standard designs.* Or you may have *special* requirements, which our staff will meet with either a modification of one of our standard designs—or an entirely new "custom-built" press.

In any case, however simple or complex your particular "pressing problem," it will pay you to secure the experienced advice and counsel of Elmes engineers. Individual recommendations and cost estimates will be supplied to you promptly on request—and entirely without obligation.

COMPRESSION and TRANSFER MOLDING PRESSES

In full range of sizes for fast work. Convenient pushbutton panel; pushbutton pneumatic reset of lower knockout; automatic position slow-down; extra large die space; many other features.

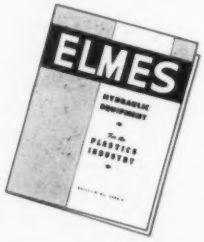


CUSTOM-BUILT PRESS — FOR LOW-PRESSURE POLYESTER RESINS

450-ton Hot Plate Press—6 single-acting cylinders set into press bed, unrestrained. Rams bear against finished pads beneath moving platen. Completely pushbutton controlled.

HYDROLAIRS®
Powered by Shop Air Line!

The answer to low-cost, high quality output for *every* plastics molder. No motors, no pumps. Easy to install. Capable. Quiet. Compact. Bench and floor models. Capacities to 50 tons. All accessories.



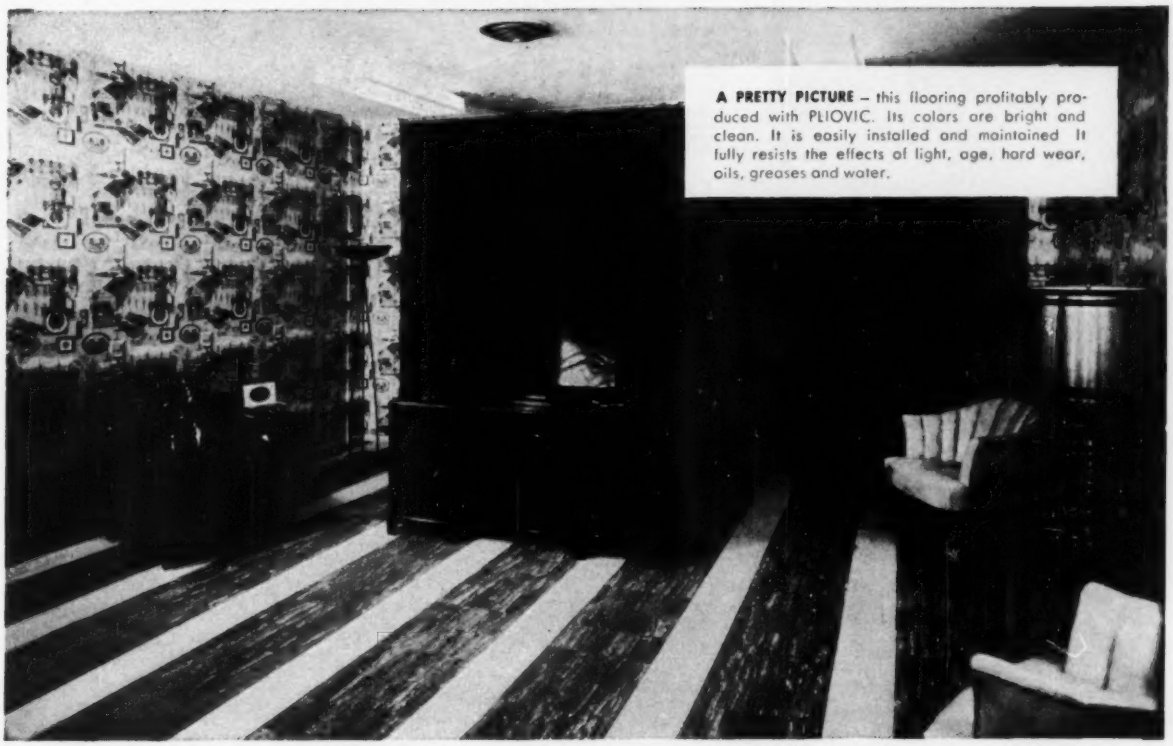
WRITE FOR BULLETIN 5200-A

Fully illustrated —gives complete information on standard-design Elmes Presses for the plastics industry.

American Steel Foundries

ELMES ENGINEERING DIVISION

METAL WORKING PRESSES • PLASTIC MOLDING PRESSES • EXTRUSION PRESSES • PUMPS • ACCUMULATORS • VALVES • ACCESSORIES



A PRETTY PICTURE – this flooring profitably produced with PLIOVIC. Its colors are bright and clean. It is easily installed and maintained. It fully resists the effects of light, age, hard wear, oils, greases and water.

and you can make it– easily and economically with PLIOVIC

HERE is top-quality vinyl flooring. Here is a highly salable product you can produce–easily and economically–consistently and profitably–with PLIOVIC, Goodyear's polyvinyl chloride resin.

PLIOVIC is so polymerized as to process easily, yet give excellent physical properties in the finished product. Its high bulk density means easier handling and full production on standard equipment. Its rapid fluxing means fast production. Its unusual heat resistance means safe color development and rerunning of scrap. Its controlled uniformity means smooth, continuous production with fewer rejects.

Get more out of your plant by putting PLIOVIC in. Get full information and technical assistance on flooring–or sheeting, film, extruded and molded goods – profitably produced with PLIOVIC, by writing to:

Goodyear, Chemical Division, Akron 16, Ohio

We think you'll like THE GOODYEAR TELEVISION PLAYHOUSE every other Sunday–NBC TV Network

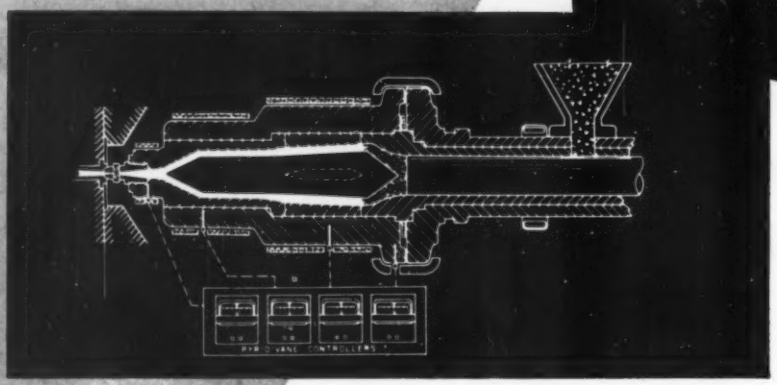
CHEMICAL GOODYEAR DIVISION

Chemigum, Pliobond, Pliolite, Pliovic–T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

Use-Proved Products—CHEMIGUM • PLIOBOND • PLIOLITE • PLIOVIC • WING-CHEMICALS—The Finest Chemicals for Industry

Boost your molding production *with* PYR-O-VANE

TEMPERATURE CONTROL



On this typical injection molding machine, two-position **Pyr-O-Vane** *instruments control the rear and flange heating zones. The critical front and nozzle zones are controlled by Pulse* **Pyr-O-Vane** *controllers, which supply heat input in pulses of controlled duration.*

YOU CAN collect valuable dividends in increased production—and decreased instrument maintenance—by applying *PYR-O-VANE* controllers to injection molding. For preheating stages, the "two-position" controller affords ample accuracy. The Pulse *PYR-O-VANE* provides time-proportioning control capable of maintaining the closest temperature tolerances in plasticizing zones.

The simplified, unit construction of *PYR-O-VANE* controllers features:

- *Interchangeability of control form . . . by simply plugging in the desired control unit.*
- *Compact case . . . standard size only 9⅞ x 8¾ inches for both instruments.*
- *Adjustable Proportional Band and Cycle Time . . . on Pulse PYR-O-VANE.*
- *High Stability . . . unaffected by ambient temperature, humidity or line voltage changes.*
- *High Resistance Circuit . . . allows use of long lead-wires.*

Our local engineering representative will welcome the opportunity to discuss applications with you. Call him today . . . he is as near as your phone.

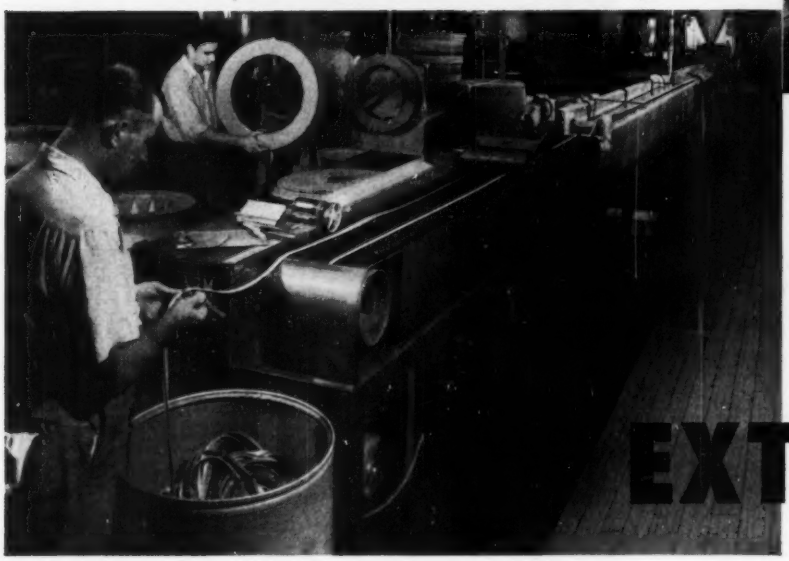
MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4437 Wayne Ave., Philadelphia 44, Pa.

● **REFERENCE DATA:** Write for Catalog No. 1053 on Pulse *PYR-O-VANE* Controller and two-position *PYR-O-VANE* Controller.

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

JARROW PRODUCTS

maintains quality in their JARENE "B" extrusions *by* EXCLUSIVE USE *of*....



NRM EXTRUDERS

In commenting on their use of NRM Extruders, S. L. Jarrow said:

"Our products have enjoyed an enviable reputation for quality for over twenty-six years. Naturally, when we went into plastics, we made *sure* this quality would be maintained. Part of the answer, of course, was hiring only top flight plastics craftsmen. The rest was up to the machines. After thorough investigations, we purchased NRM Extruders, and they have met our rigid requirements 100%. We use NRM's *exclusively*, and have recently ordered additional NRM equipment."

It is logical that Jarrow's investigations should lead them to NRM . . . builder of highest quality plastics extrusion equipment. The precision with which NRM equipment is built helps *many* plastics extrusion companies such as Jarrow maintain the high standard of their product, and assures them years of maintenance-free operation at peak capacities. NRM features such as balanced heat control, quick opening die gate, patented screw design and "Cyliner" construction, result in a machine which is adaptable for extrusion of *all* thermoplastic compounds. If *you* are planning to purchase plastics extruding equipment, check with NRM today. Your inquiry brings full details, promptly, without obligation.

In the top photo Lee Swift, Manager of the Plastics Division of Jarrow Products, checks a JARENE "B" gasketing profile as it comes from an NRM 2½" electrically heated plastic Extruder.

•

Lower left, NRM accessory equipment works in conjunction with NRM Extruders to produce refrigerator door gaskets, in Jarrow's new plastics division.

2185

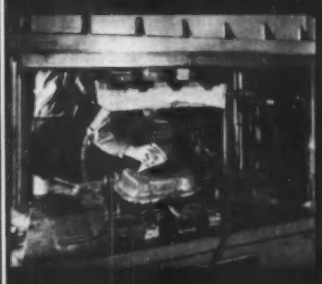
NATIONAL RUBBER MACHINERY COMPANY

NRM

Our 25th ANNIVERSARY 1928-1953

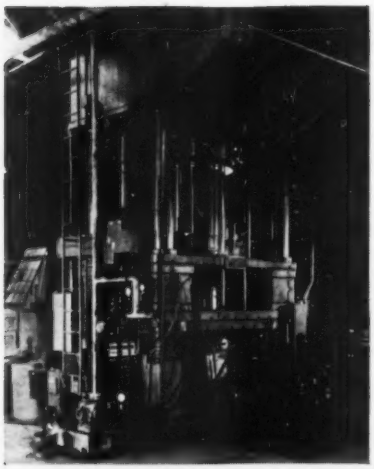
Creative Engineering

General Offices & Engineering Laboratories: Akron 8, Ohio
East: 384 Getty Ave., Clifton, N. J.
West: S. M. Kipp, Box 441, Pasadena 18, Cal.
Export: Omni Products Corporation, 460 Fourth Ave., New York 16, N. Y.



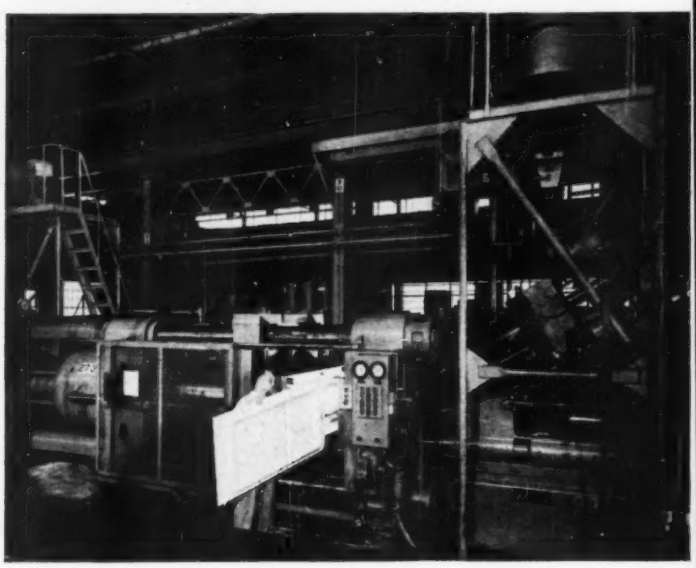
Complete facilities for making tough, strong, reinforced plastics as large as 5′ x 7′ x 2′.

Good ideas molded in plastics by



This 2,000 ton compression press molds a complete console television cabinet every few minutes.

Batteries of huge 300-oz. injection presses produce—in one shot—a complete inner door panel for a 12 cu. ft. refrigerator.



General American

You may be able to do more with plastics than you thought you could! At General American, we're working with manufacturers who never before had considered plastics. Old limitations of size, shape and color are being removed. New design possibilities and styling are adding saleability to products and parts of all kinds.

By taking full advantage of equipment that is unmatched anywhere for large-scale injection, compression and reinforced plastics molding, we've been able to improve old products, mold many new products—as well as cut production costs for customers.

We'd like to help you see your ideas take form in plastics *correctly applied.*

See General American for plastics molding

PLASTICS DIVISION

General American Transportation Corporation

135 South La Salle Street • Chicago 90, Illinois

Phone: Financial 6-4100

PLASTICS DIVISION GENERAL AMERICAN TRADE MARK

From Coal to Plasticizer
in 299 yards!

WHEN only a few hundred yards separate your raw materials from your finished product, you're *really* basic! That's exactly the way we produce Pittsburgh PX Plasticizers . . . in a basic and integrated operation from coke ovens, through coal chemical and phthalic anhydride plants to final shipment from our modern new plasticizer plant.

The result? Quality-controlled production every step of the way, and a broad family of thirteen plasticizers with the high standards of purity, water-whiteness and stability you want. There's a good chance our engineers will be able to help you achieve better, more efficient production at your plant. Why not call or write us about it, *today!*

PITTSBURGH PX PLASTICIZERS

PX-104 DiButyl Phthalate
PX-108 DiIsoOctyl Phthalate
PX-109 DiNonyl Phthalate
PX-138 DiOctyl Phthalate
PX-158 DiCapryl Phthalate
PX-208 DiIsoOctyl Adipate
PX-209 DiNonyl Adipate
PX-238 DiOctyl Adipate
PX-404 DiButyl Sebacate
PX-408 DiIsoOctyl Sebacate
PX-438 DiOctyl Sebacate
PX-658 TetraHydroFurfuryl Oleate
PX-917 TriCresyl Phosphate

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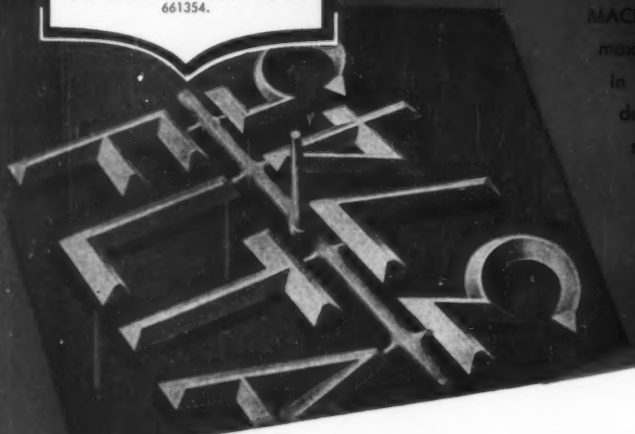
PITTSBURGH
COKE & CHEMICAL CO.

COAL CHEMICALS • AGRICULTURAL CHEMICALS • FINE CHEMICALS • PROTECTIVE COATINGS • PLASTICIZERS • ACTIVATED CARBON • COKE • CEMENT • PIG IRON

facts

12,000
SHOTS *per* WEEK

8-impression moulding in polythene, of automobile number plate digits and letters. Mould designed and mouldings produced by the Mentmore Manufacturing Co. Ltd. in conjunction with Hills (Patents) Ltd. under Patents Nos. 661276 and 661354.



that speak for themselves

This record of weekly production can be taken as typical of the first-class performance of PECO MOULDING MACHINES. Their output can be relied on—and it is a maximum output for any type of production.

In the 8 oz. and 16 oz. machines, important new developments have been introduced, giving increased shot capacity and enabling these models to be uprated to, respectively, 8/10 oz. and 16/24 oz. machines. Further details of the full range, including smaller capacity machines, will be gladly sent on request.

PECO 8/10 OZ. INJECTION MOULDING MACHINE

MOULDS

PECO MOULDS. Tested designers and makers of moulds of every description and moulds can be supplied to complete specification, including machining, polishing and chromium plating if required. An important side of the Company's work is the hobbing of moulds for plastics and a modern automatic hobbing press forms part of the equipment. Advice and assistance on moulding matters is available to customers.

PECO PRODUCTS

THE PROJECTILE & ENGINEERING COMPANY LTD.

ACRE STREET, BATTERSEA, LONDON, S.W. 8, ENGLAND

Plastic **EXTRUSIONS** can be used in your product too! We have just published a 12 page brochure containing 36 illustrated examples that demonstrate how various industries use thermo-plastic extrusions in their products.

You can get ideas of how custom-made rods, tubes and other shapes may be used in your products or processes. The brochure also contains full information on plastic materials, specifications and property tables.

You will find this brochure informative and profitable. *Write for your free copy of* "EXTRUDED PLASTICS" *or clip the coupon and attach to your letterhead.*

PLEASE SEND A COPY OF "EXTRUDED PLASTICS" TO

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ANCHOR PLASTICS

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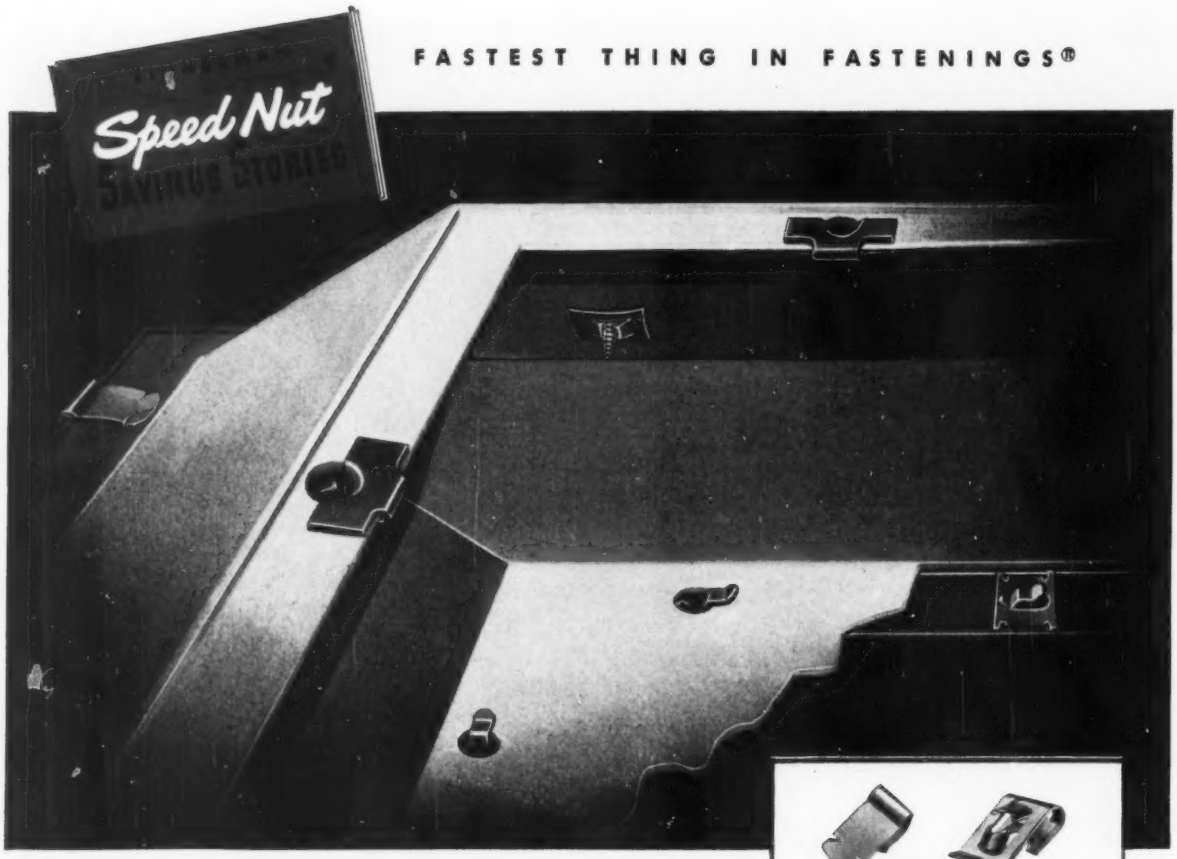
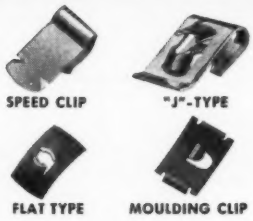
36-36 36TH STREET • LONG ISLAND CITY 6, N. Y.

FASTEST THING IN FASTENINGS®





These four SPEED NUTS perform important time-saving functions in the assembly of the Everbrite sign shown in cutaway illustration above. Made of highest quality spring steel, SPEED NUT fasteners are lightweight, self-retaining and vibration-proof.

Plastic Sign Maker "Signs Up"
48% SPEED NUT® Savings!

Everbrite Electric Signs, Inc., Milwaukee, Wisconsin, has found the "sign of savings" in Tinnerman SPEED NUT brand fasteners. Designers at Everbrite specified 4 different types of SPEED NUTS in the production of these smart plastic signs. The result was an estimated savings of 48% in assembly time, cost of materials, and materials handling!

SPEED NUT applications in plastics present unlimited money-saving opportunities. Production advantages like these are the reasons . . . SPEED NUTS eliminate costly threaded inserts, are self-retaining and vibration-proof, make faster, easier "blind" attachments, permit greater design flexibility, harness cold-flow tendencies, eliminate heat sealing, and minimize assembly damage!

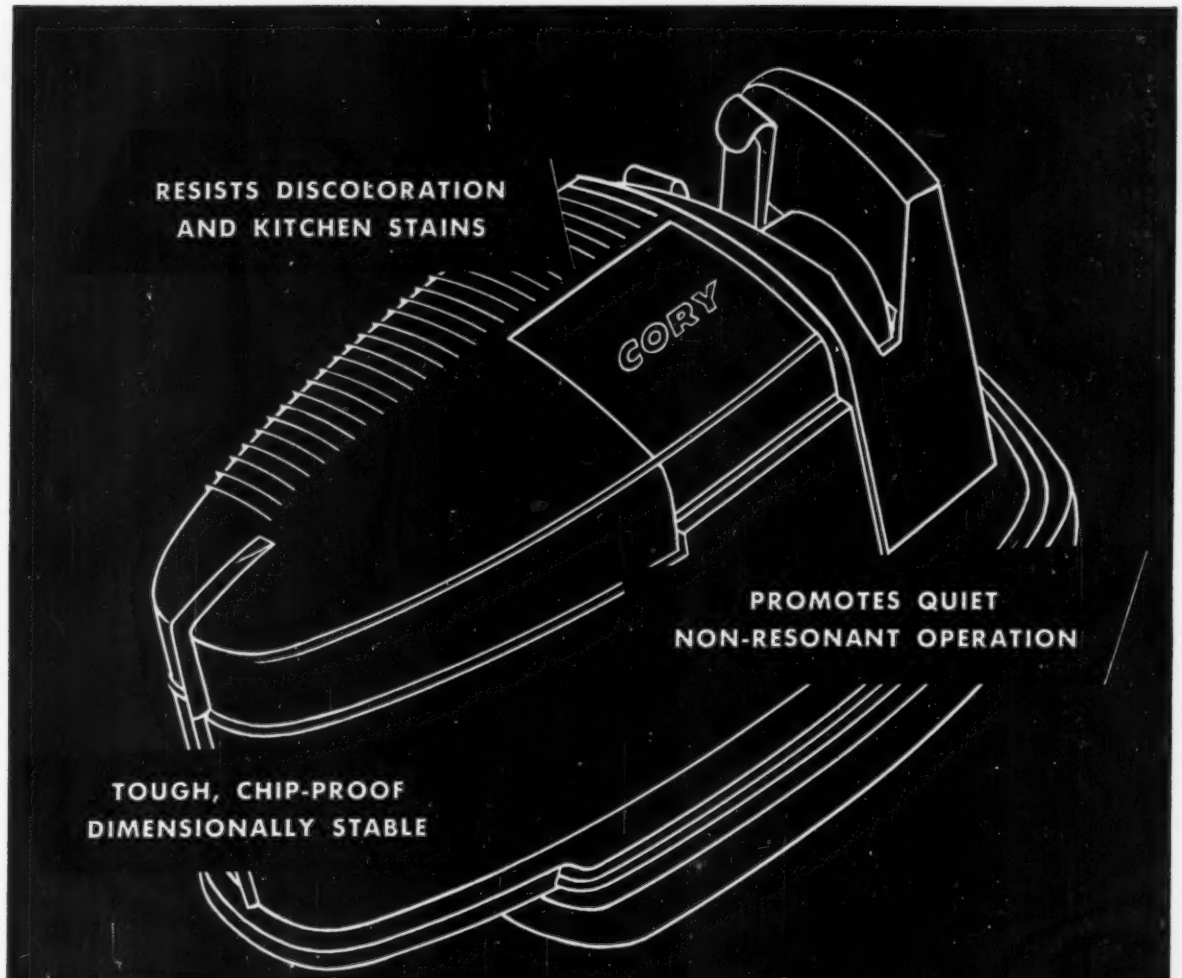
For cost-saving details on the use of SPEED NUTS in plastics, call in your Tinnerman representative.

Send for your "SAVINGS STORIES" booklet of interesting SPEED NUT savings to industry. Write today:

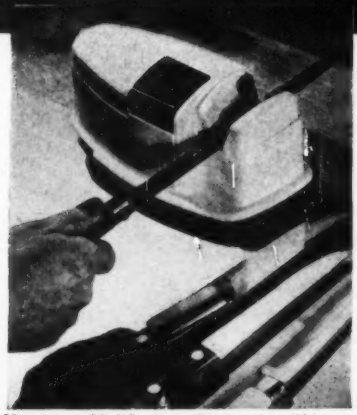
TINNERMAN PRODUCTS, INC., Dept. 12, Box 6688, Cleveland 1, Ohio. *In Canada:* Dominion Fasteners Ltd., Hamilton, Ontario. *In Great Britain:* Simmonds Aerocessories, Ltd., Treforest, Wales. *In France:* Aerocessoires Simmonds, S. A. – 7 rue Henri Barbusse, Levallois (Seine).

TINNERMAN Speed Nuts®

MORE THAN 8000 SHAPES AND SIZES



CORY designed to sell with HERCOCEL®



Housing molded for Cory Corporation, Chicago, Ill., by G-M Laboratories, Inc., Chicago, Ill.

Housed in Hercocel A, the new Cory Electric Knife Sharpener has everything that makes for economical production and profitable sales. The gleaming white, attractively styled housing is quickly molded in one piece. It's tough, dimensionally stable . . . proof against casual kitchen handling. The porcelain-like finish, with color through and through, is stain-resistant . . . can't chip, peel or wear off. And Hercocel, non-resonant itself, helps assure quiet operation of the unit. For complete information on Hercocel plastics, and details of the design and technical assistance offered by Hercules, write:

HERCULES POWDER COMPANY
INCORPORATED
Cellulose Products Department, 916 Market St., Wilmington 99, Del.

CP53-7

Egan

extruder

Remote Control Panel

FOUR SEPARATE MAIN COMPONENTS

● "Tailored" Screw ● Independent Thrust Bearing Housing

● Individual Feed Section ● Heavy Wall Cylinder

Internal wiring for extruder and control panel complete to coded terminals for quick installation at any location.

ALL WITH IMPROVED FEATURES

for increased production, reduced maintenance and complete flexibility. Designed to meef *ANY* requirements. Can be supplied complete with dies and take-off equipment.

Write for details or invite our representative to call

FRANK W. EGAN & COMPANY

Designers and Builders of Machinery for the Paper Converting and Plastics Industries

Bound Brook, New Jersey

what do the properties of

ATTASORB®

mean to you?

Here is a uniform, ultra-fine, highly sorptive and remarkably inexpensive mineral powder that has recently been developed for commercial use by the Attapulgus Mineral & Chemicals Corporation.

Resin and molding compound manufacturers are using ATTASORB as an anti-caking agent. It prevents agglomeration and lumping of granular resins and plastics, such as the phenolics, polyesters, vinyl and styrene polymers and copolymers, alkyd resins, and ethylenes as well as many other hygroscopic or waxy chemicals . . . keeps them in a free-flowing state even under the most adverse conditions of processing or storage.

Formulators and molders are testing ATTASORB as a high quality, *highly sorptive* filler that is still low in cost. Because of its mineral nature, ATTASORB should give molded products increased heat and flame resistance. For the same reason, formulations with ATTASORB should show good electrical characteristics. Indications also point to lowered curing times with the use of ATTASORB.

Best of all, a little bit of ATTASORB goes a long way. It takes a minimum of this light weight, highly sorptive powder to gain the maximum advantages of a quality filler. Product quality can be kept at a peak with ATTASORB.

Look over the list of ATTASORB properties. And then write for a generous free sample. Descriptive literature and technical assistance are also yours for the asking.

* IMPORTANT PROPERTIES OF ATTASORB

FINENESS: Average particle size 0.4-0.6 microns (air permeation method).

SURFACE AREA: Total active surface area equal to 13 acres per pound.

SORPTIVE CAPACITY: Can absorb 35-40% water, oil or other liquids without loss of flowability. Oil absorption index 125-130 (conventional ASTM rub-out method).

SHAPE: Needle-like.

COLOR: Light cream. Index of refraction: 1.56.

pH VALUE: 7.5-8.5 (slurry method)

BULK DENSITY: 13-15 lbs./cu. ft.

TRUE DENSITY: 2.45 g/cc.

COMPATIBILITY: Chemically inert. Compatible with most chemicals.

PRICE: 3c to 3½c per pound, depending on freight charges.

ATTAPULGUS Minerals & Chemicals Corporation

DEPARTMENT J

210 WEST WASHINGTON SQUARE, PHILADELPHIA 5, PA.

SEE OUR EXHIBIT—Space S-57, 24th Exposition of Chemical Industries, Philadelphia, November 30-December 5.

Baldwin Presses provide the uniform temperatures needed to keep LAMICOID® quality high . . .

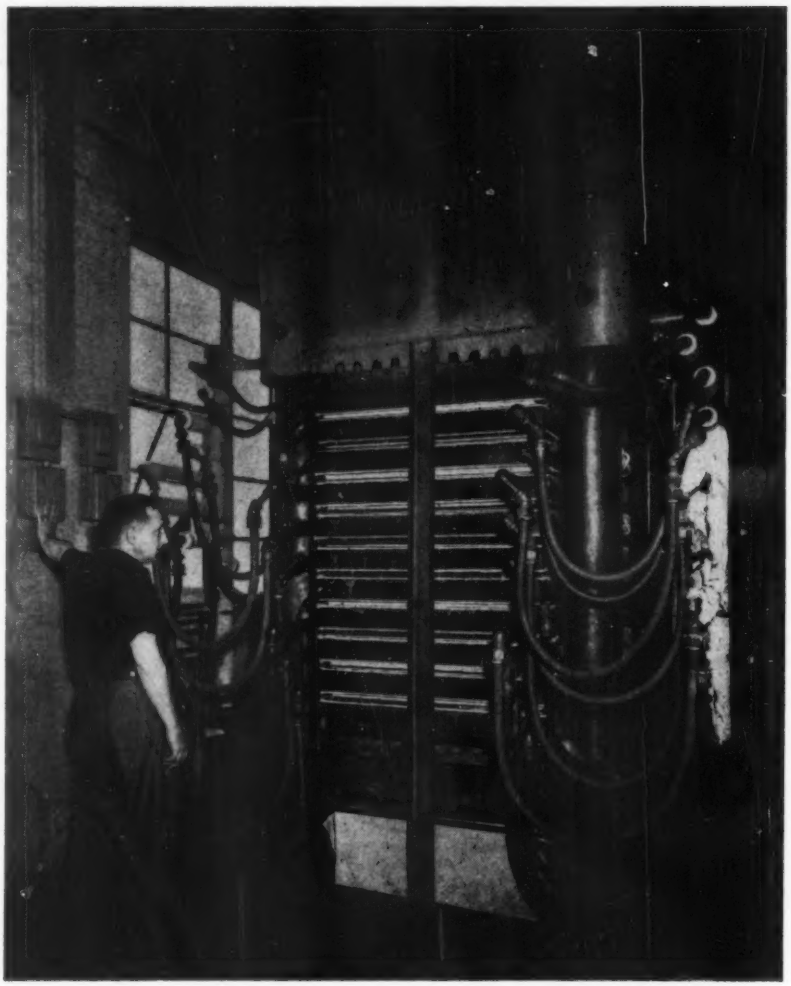
THE PROBLEM:

In manufacturing Lamicoid as a carefully controlled high quality product, Mica Insulator Co., Schenectady, required presses which would enable them to maintain precise temperatures during the curing cycle.

THE BALDWIN SOLUTION:

Mica reports that Baldwin presses have provided consistently the uniform heat and pressure which cure uniformly, prevent warping and avoid discoloring of laminated sheets. A further benefit to Mica is the fact that their seven Baldwin presses, in operation for seven to eighteen years, have been exceptionally free of maintenance problems and costs.

Papers and cloths of all types (including asbestos and glass cloths), impregnated with thermo-setting synthetic resins, are cut to size and stacked in layers to produce the desired thickness. These stacks are then placed in hydraulic presses like this Baldwin for final cure. The various grades and types of Lamicoid are cured at varying pressures and temperatures ranging up to 1,200 pounds per square inch and approximately 350° F. for varying lengths of time.



What's your pressing problem?

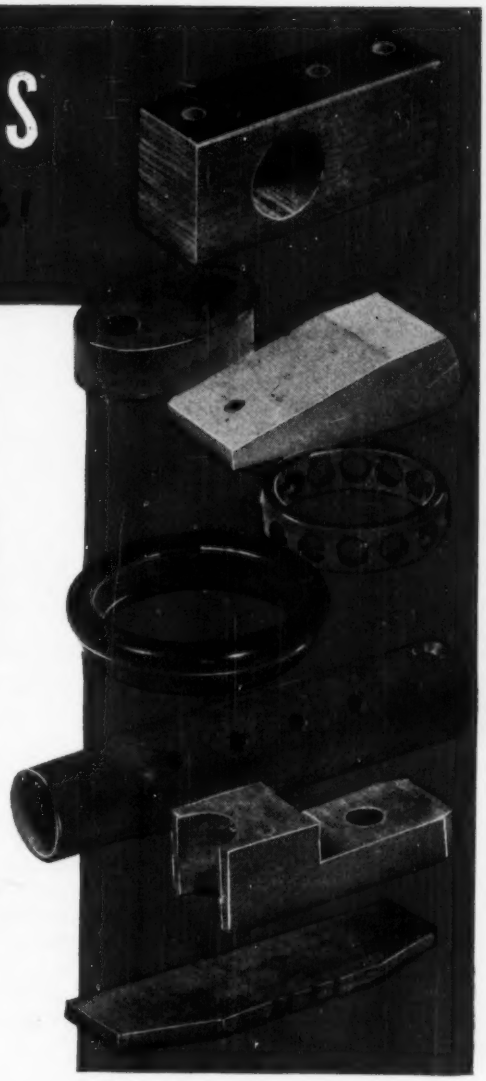
No matter what your needs might be, Baldwin can help you promptly by analyzing your problem and recommending the standard or special Baldwin press for laminating or moulding plastics or rubber. For full details about the full line of Baldwin steam platen and compacting presses, please write for Bulletins 185 and 186 to Dept. 4526, Baldwin-Lima-Hamilton Corporation, Philadelphia 42, Pa.

BALDWIN BLH LIMA-HAMILTON

BALDWIN-LIMA-HAMILTON

Philadelphia 42, Pa. • Offices in Principal Cities

LIGHTWEIGHTS



Spaulding products for industry weigh only one-half as much as aluminum. Yet they show excellent performance characteristics in tough applications in industrial machines.

The secret? These Spaulding products have extreme light weight ***in combination with*** structural strength, resistance to wear, dimensional stability, clean machining and quietness in mechanical operation.

Other types and grades of Spaulding products exhibit many different combinations of electrical, chemical and mechanical properties. Among them may be just the one you need to solve a difficult design problem, improve product performance or lower production costs.

Write or phone your nearest Spaulding Branch Office for full information.

Spaulding

SPAULDING FIBRE COMPANY, INC., TONAWANDA, N. Y.

MAKERS AND FABRICATORS OF:

VULCANIZED FIBRE: In sheets, rods, tubes and fabricated parts.
ARMITE: Thin Insulation (Fish Paper) in sheets, rolls, coils and fabricated parts.
SPAULDITE: (Laminated Phenolic Plastic) in sheets, rods, tubes and fabricated parts.
SPAULDO: Motor Insulation in sheets, rolls, coils, slot cells and other fabricated parts.
SPAULDING FIBRE BOARD: In sheets and fabricated parts.
SPAULDING T BOARD: A superior Transformer Board, in sheets and fabricated parts.
MATERIALS HANDLING EQUIPMENT: Factory trucks, Boxes, Barrels, Trays, etc.

SPAULDING FABRICATING FACILITIES

Spaulding's fabricating facilities for these products are unsurpassed the world over. You can save time and money by letting us do your fabrication. We'll be glad to quote on specific jobs without obligation to you.

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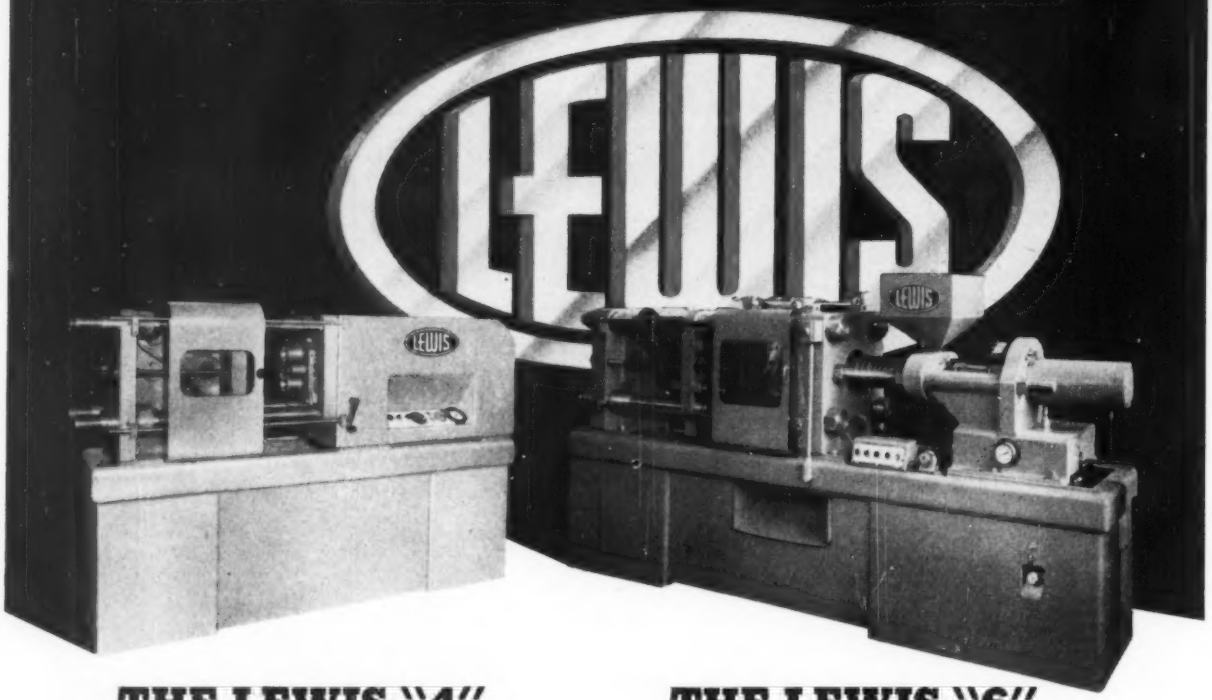
28 Jackson Ave.

TODAY'S OUTSTANDING MOLDING MACHINES . . .



THE LEWIS "4"

This small size injection molding machine can mold large projected area parts originally produced on 8-ounce equipment. Compact and simple to operate, the LEWIS "4" is the lowest cost molding machine available today for high speed production of 2 to 3 ounce parts. Plasticizing capacity is 30 pounds of material per hour.

Features of the LEWIS "4" include multiple shot injection . . . semi-automatic operation . . . ability to work with almost any molding material. Clean, simplified construction assures maximum production with minimum maintenance . . . fast opening crank-operated die-lock mechanism clears jammed nozzles in 20 seconds or less.

The LEWIS "4" requires only 16 square feet of floor space. This machine will handle molds up to 12"x23" mounted vertically and 13⅜"x20" mounted horizontally.

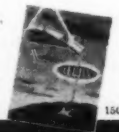
Write for Bulletin 101 describing the Model "4".

THE LEWIS "6"

Designed for production molding a wide range of parts having large projected areas, the LEWIS "6" does the work of considerably larger units at a fraction of their initial and normal operating costs. This machine will plasticize up to 60 pounds per hour and shots greater than 7 ounces of polystyrene can be molded at the rate of 2½ per minute. The LEWIS "6" features the exclusive new "HYDRA-LOCK", the safest and most powerful hydraulic clamping device available today. Requiring only a cupful of oil, the "HYDRA-LOCK" develops a 200-ton clamping pressure in tenths of a second. In addition, the "HYDRA-LOCK" clamp's design facilitates quicker, easier mold setting procedures.

All features of the LEWIS "6" are included in one remarkably low price. These include injection pressures up to 15,000 psi, large area platens, compensating feed, finger tip controls, fast opening die-lock mechanism, automatic molding cycle and minimum maintenance.

Write for Bulletin 102 describing the Model "6".



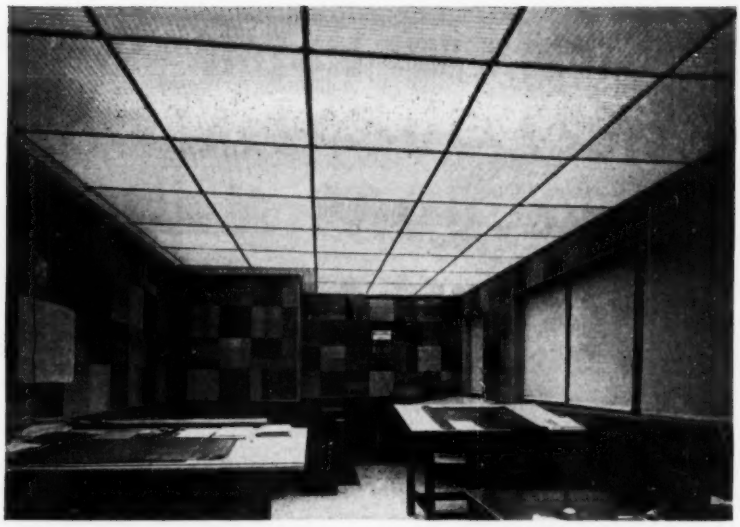
1506-LW

LEWIS

THE LEWIS WELDING & ENGINEERING CORP.

11 INTERSTATE STREET BEDFORD, OHIO

for Ceiling or Selling...



VINYLITE RIGID SHEETS!

Such varied jobs grow naturally out of the many useful properties of VINYLITE Brand Plastic Rigid Sheets.

This glowing, sweeping ceiling is made by placing lightweight VINYLITE Rigid Sheets on channels supported from above. It conceals pipes, ducts and lighting fixtures. It diffuses light to every corner of the room. Harsh glare and shadows are gone. The whole room has a cleaner, brighter look.

VINYLITE Rigid Sheets make outstanding signs and displays—printed in color, then easily heat-formed to three dimensions or decorated after forming. They're tough and flexible—resist warping, cracking, moisture, grease. A damp cloth cleans them. Translucent areas can be illuminated.

Transparent, translucent, or opaque, VINYLITE Plastic Rigid Sheets come in a variety of widths and thicknesses. Their surfaces are matte, press-polished, or a combination of both. Their uniformity in thickness cuts down on rejects during forming operations.

Perhaps they can help you turn out a new, improved product that will mean more sales. You'll find some successful, practical ideas and a full description of properties in the booklet "VINYLITE Plastic Rigid Sheets." Write for your free copy to Dept. QX-7.

Flexi-Module ceiling installation by Sylvania Electric Products Inc., Wheeling, West Virginia. Plastics of Marlux, fabricated by Marlux Corp., Somerville 43, Mass.

Sign by Timely Products Manufacturing Company, Des Moines, Ia.

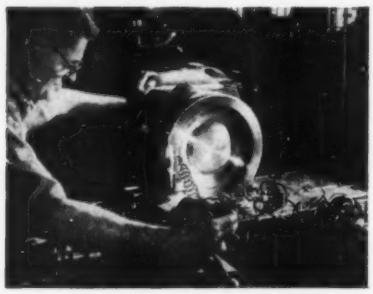
Vinylite
BRAND
PLASTIC RIGID SHEETS
TRADE MARK
BAKELITE COMPANY
A Division of
Union Carbide and Carbon Corporation
UCC
30 East 42nd Street, New York 17, N. Y.

SERVING THE CUSTOMERS OF NEWARK DIE

all combine to turn out molds

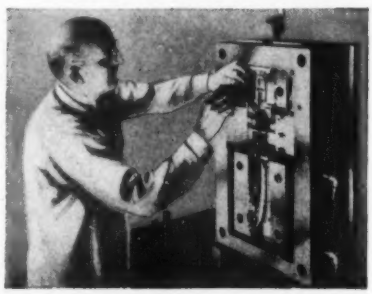
that meet the most exacting requirements of the molders and users of plastic parts

SPECIALISTS IN MOLD ENGINEERING



THE HANDS OF SKILLED CRAFTSMEN

THE MOST MODERN EQUIPMENT



AND RIGID INSPECTION

At every stage from the study of the blueprints or models for the plastic part to the completion of the finished mold, Newark Die brings to its customers the skill and experience resulting from more than 30 years of precision moldmaking.

Old skills—new machines—turn out the molds that have kept the same molders coming back to Newark Die, year after year. The type of mold, too, that keeps molders' *customers* coming back to *them* year after year.

NEWARK DIE COMPANY

22 SCOTT STREET, NEWARK 2, N. J.

Phone MArket 2-3303

NDCo TRADE MARK

Here's the key to REALLY SUCCESSFUL FILM PRODUCTION

This diagram shows a matched production unit, developed by Farrel-Birmingham engineers, for processing plastic film and coatings. It consists of two 3A Banbury* mixers, two 22" x 60" mills, a 28" x 66" 4-roll "Z" calender, cooling drums and windup. The speed of the calender is adjusted to absorb the 3,000 pounds per hour output of the two Banbury mixers to provide an even and continuous flow of production.
Banbury Mixers
Roll Removing Hoist
Feed Mills
Four Roll "Z" Calender
Cooling Drums
Slitter
Surface Winder
*Trade mark of Farrel-Birmingham Co., Inc.

When Farrel-Birmingham developed the "Z" calender, production of plastic film took a giant step forward. The reason: *finer control of gauge.*

This machine, with its unique roll arrangement, positive roll positioning, flexible and extremely sensitive roll adjustment, and precise temperature control, has actually brought the production of calendered film and sheet to new levels of accuracy, quality, and speed.

Light, unsupported films are being commercially produced on the "Z" calender down to thicknesses of .002" and less, with gauge tolerances held within plus or minus .0001". Employing the crossed-axes device on the final pass, this accuracy can be maintained over a considerable range of light films.

Using this same device, comparable accuracy in the production of heavier films and sheet is possible over as wide a gauge range as .004" to .020".

Send for more information about this revolutionary development — the "Z" calender. Or, if you prefer, a Farrel-Birmingham engineer will be glad to discuss your film production problems with you.

FARREL-BIRMINGHAM COMPANY, INC.
ANSONIA, CONNECTICUT
Plants: Ansonia and Derby, Conn., Buffalo, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Akron, Chicago, Los Angeles, Houston

FB-830

Farrel-Birmingham®

What's Screwy? by Phillips

"Nope! Not more than 3 Phillips Recessed Head Screws for the lot. After all, it's only ivory."

PERFECTLY MATED! Only Phillips Drivers are perfectly mated to Phillips Screws. Look for the name Phillips on the shank.

SALES VALUE is only one of many advantages added to your product when you use Phillips Screws. These screws also save money, work, time. They eliminate driver skids, damaged parts and split screw heads. They cut driving time up to 50%. And they set up tighter having a maximum strength of head due to their design. For best results, choose Phillips Wood, Machine, Tapping Screws or "Sems."

PHILLIPS *Cross-Recessed-Head* SCREWS

X marks the spot... the mark of extra quality

AMERICAN SCREW COMPANY • ATLANTIC SCREW WORKS, INC. • THE BLAKE & JOHNSON CO.
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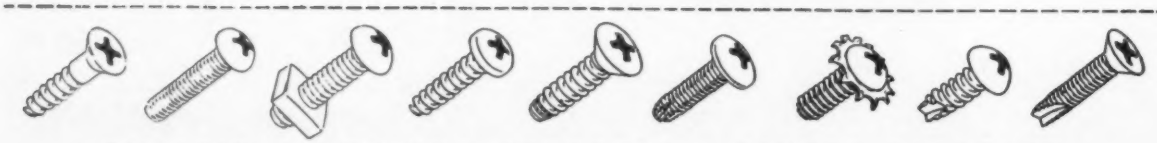
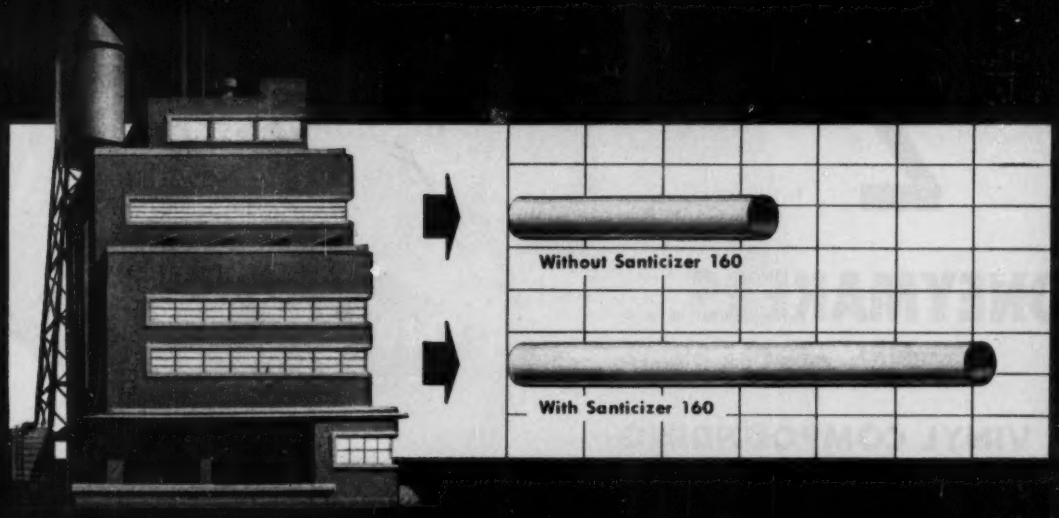


TODAY'S ..AND THE FUTURE'S...FINEST FASTENER

Increase in Output 80% · No Increase in Equipment with SANTICIZER 160



The owner of a vinyl extrusion plant, in a southeastern state, was faced with a major problem: *How to increase production most efficiently?*

He called in Monsanto technical and sales personnel. They went into his plant . . . worked side by side with his technicians. They varied fillers and screw speeds, replaced one monomeric and one polymeric plasticizer with Santicizer 160. Their recommendations produced these results:

- *Production capacity increased 80% . . . with no increase in equipment.*
- *Cost of raw materials cut one cent per pound.*
- *Smooth surface and trueness of contour fully maintained.*
- *No loss in tensile strength, softness, low temperature flexibility or other important properties.*

Find out what Santicizer 160 or Santicizers 140 and 141—which are also fast processing plasticizers—can do for you. For information on prices, delivery and performance, call the nearest sales office or MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 800 North Twelfth Blvd., St. Louis 1, Mo.

Santicizer: Reg. U. S. Pat. Off.

SANTICIZER 160

MONSANTO CHEMICALS — PLASTICS

Serving Industry . . . Which Serves Mankind

2 MONEYMAKERS...

FOR VINYL COMPOUNDING

Chlorowax 40* and Surfex* can be used separately or in combination to lower vinyl compounding costs and increase batch yields with no sacrifice in quality. Chlorowax 40 is DIAMOND ALKALI's liquid chlorinated paraffin which has proved highly satisfactory as a low-cost co-plasticizer. Surfex is one of DIAMOND's precipitated calcium carbonates—a reagent extender of high uniformity and purity.

The table indicates how these two DIAMOND chemicals may be applied in vinyl compounding to produce two-way savings. Specific formulas are available through your nearest DIAMOND Sales Office.

*®

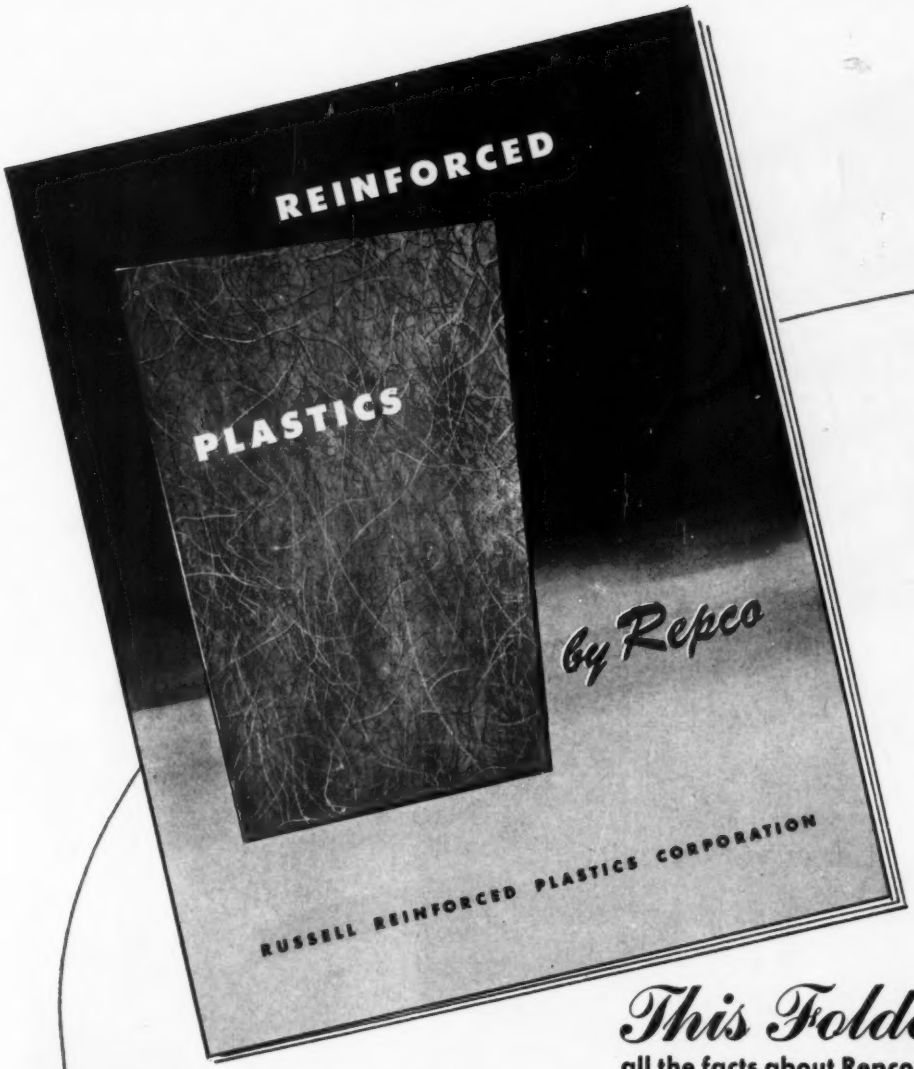
	PARTS	
PVC RESIN	100	100
PRIMARY PLASTICIZER	52	47
*CHLOROWAX 40**	—	15
STABILIZER	3	3
STABILIZER—LUBRICANT	0.5	0.5
*SURFEX**	—	15
TOTAL	155.5	180.5
ESTIMATED MATERIAL COST LB. VOL.	45.8¢	41.6¢
YIELD—% INCREASE PER LB. OF RESIN		11 (By Vol.)
HARDNESS	85A	85A
TENSILE STRENGTH	2600 psi	2600 psi
ELONGATION	375%	375%
100% MODULUS	1400 psi	1400 psi
CRESCENT TEAR	375 lbs. in.	375 lbs. in.
BRITTLENESS—TEMPERATURE	-31°C	-29°C
HEAT LOSS	5.5%	4.7%

DIAMOND SALES OFFICES: New York, Philadelphia, Pittsburgh, Cleveland, Cincinnati, Chicago, St. Louis, Memphis and Houston. Also representatives in other principal cities.

DIAMOND CHLOROWAX 40 AND SURFEX

DIAMOND ALKALI COMPANY...CLEVELAND 14, OHIO

DIAMOND ALKALI CHEMICALS ®



Repco Plastics*

This Folder gives you all the facts about Repco Plastics . . . about products, techniques and facilities. It will prove a valuable reference to all those who must keep abreast of the latest developments.

Reinforced plastics, possessing a unique combination of properties that no other single material can claim, open an entirely new field for products in every industry.

Zip it now
AND ATTACH TO
YOUR LETTERHEAD

RUSSELL REINFORCED PLASTICS CORP.
WEST HOFFMAN AVENUE
LINDENHURST, L. I., N. Y.

Please send me a free copy of
"REINFORCED PLASTICS by REPCO"

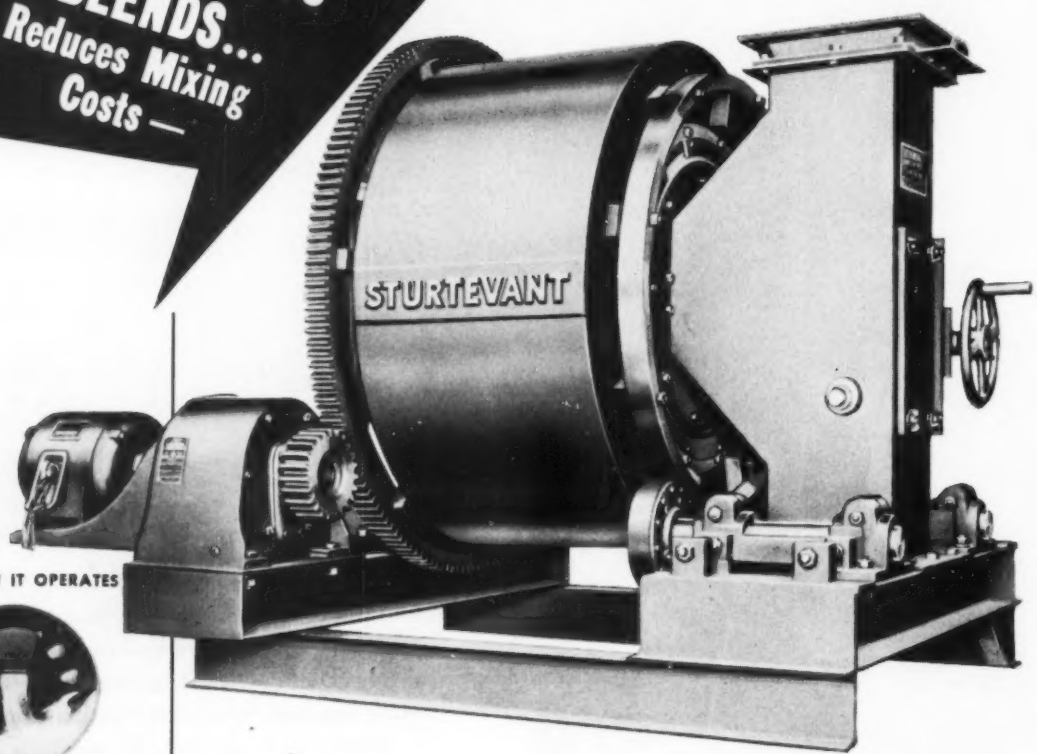
NAME .....

TITLE .....

*T. M. Reg.

4 WAY MIXING ACTION PRODUCES HOMOGENEOUS BLENDS... Reduces Mixing Costs —

with the STURTEVANT BLENDER



HERE'S HOW IT OPERATES

RECEIVING

As the materials are received, they are picked up by scoops and cascaded from the top of the machine. At the same time, the revolving drum forces the materials from both ends toward the center of the drum . . . while the swinging chute, which is in mixing position, produces a fourth lateral mixing action.

DISCHARGING

By simply throwing a lever, the inlet is closed and the blender is in discharging position. The completely mixed materials drop off the lifting scoops and discharge through chute without segregation of ingredients.

Four separate mixing actions in the Sturtevant Blender assure complete blending of various materials regardless of weights, densities, finenesses, or other physical properties.

This mixing action provides a thoroughly blended product with no substances floating to remain unmixed.

Sturtevant Blenders are available in mixing capacities from 500 to 20,000 pounds. Write for information or engineering assistance.

STURTEVANT MILL COMPANY

110 CLAYTON STREET, BOSTON 22, MASSACHUSETTS

Designers and Manufacturers of

CRUSHERS • GRINDERS • SEPARATORS • CONVEYORS • MECHANICAL DENS and EXCAVATORS • ELEVATORS • MIXERS

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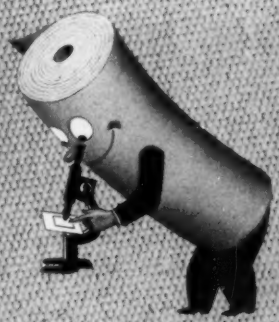
Makes The Big Difference
In LAMINATION FABRICS

MT. VERNON EXTRA

Gives You Greater Fabric Uniformity



Checking evenness of roving with Belger Tester.

One of a series of comprehensive laboratory controls throughout production to assure uniformity in all Mt. Vernon-Woodberry products.

Mt. Vernon-Woodberry Mills

Branch Offices: Chicago • Atlanta
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TURNER HALSEY
COMPANY
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FABRICS ENGINEERED TO FIT YOUR NEEDS

Need adaptation of an existing fabric to your special purposes? Or creation of an entirely NEW fabric — cotton, synthetic or blend — to meet your specifications? Mt. Vernon-Woodberry's staff of textile engineers is available on request to help you with your problems in development or application of industrial fabrics.

You saw this ad in Tool Engineer, Machinery, Western Machine Shop, American Machinist, Iron Age

and at CRUCIBLE MOLD STEEL *is* TOOL STEEL

Take our experience as tool steel leaders for more than 50 years — add it to the unique staff of mold steel specialists we maintain — and the result is *better* mold steel!

That's why Crucible mold steels are consistently chosen for most exacting molds. And why mold steel users are checking our strategically located warehouses for stocks to meet their needs.

Give us a call.

Visit us at Booth 241, National Metal Show, Cleveland, Ohio, October 19-23

WRITE TODAY FOR YOUR TOOL STEEL SELECTOR

Get your copy of the unique Crucible Tool Steel Selector — a quick twist of the dial gives you the right tool steel for the right job. And it will help you select mold steel! Selector has 9-inch diameter; printed in 3-colors.

CRUCIBLE first name in special purpose steels

53 years of Fine steelmaking

MOLD STEEL

CRUCIBLE STEEL COMPANY OF AMERICA · TOOL STEEL SALES · SYRACUSE, N. Y.

TWIN WELTERWEIGHTS (8 oz.) ONE-HANDEDLY BEAT OUT TWO-HANDED HEAVYWEIGHT

Or, in molding shop language, production went UP when single-cavity molds on two Fellows 5C-8 speed machines took over from two-cavity molding on one 16 oz. machine.

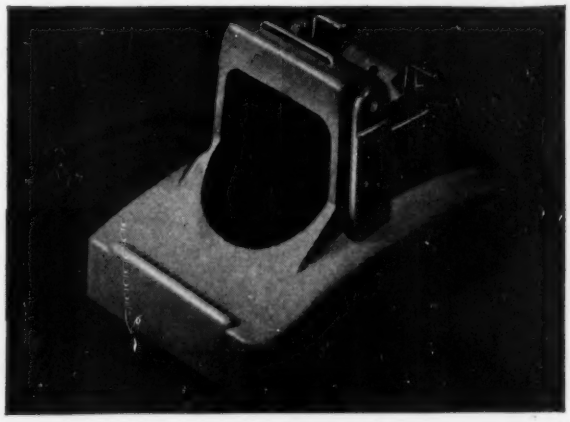
We'll get no argument that, as far as net speed per cycle goes, a Fellows Injection Molding Machine runs rings around the slower 'Big' machines. Nor is there much argument over the shop-profit importance of a-b-s-o-l-u-t-e s-p-e-e-d in pieces per hour.

Give any operator ability to turn out enough *more pieces* per man—per hour, and per dollar of total overhead, and the way is open to *produce and sell for profit.*

This color-styled telephone cover device isn't too easy to mold. The sections vary in thickness so cycling has to be accurately controlled to hold close-limit dimensions. Flow lines and sinks would cause immediate rejection. It's a job for a skillful molder—and the results prove that the right man was assigned the job in this case.

• Machines Speed Pays Off

It took imagination and an eye for the *ultimate profit dollar* to dare to re-make the molds to put the job on



speedy Fellows 5C-8s—two of them. But it paid off—as is to be expected!

The outstanding contribution which Fellows has made to injection molding, summed up in one word, is SPEED... and that means SUSTAINED SPEED, backed by mechanical reliability, automatic operation and *service* that sets Fellows in a class apart.

{ *If cost-cutting is your problem, get in touch with Fellows. The 3 oz. and 8 oz. Speed-Flo Injection Molding machines are the pace-setters of the industry. Write, wire or phone the nearest office.* }

Fellows

injection molding equipment

THE FELLOWS GEAR SHAPER COMPANY, Plastics Machine Division, Head Office and Export Department, Springfield, Vermont
Branch Offices: 323 Fisher Bldg., Detroit 2, Michigan • 5835 West North Avenue, Chicago 39, Illinois • 2206 Empire State Bldg., New York 1, N. Y.

Roving to meet your needs . . .

If you're using fiber glass roving, these facts about Pittsburgh Roving are important to you:

1. Packaged with a uniform tension that improves performance in automatic feeding operations.

2. Complete range of packaging. In addition to standard 35-pound packages in 60 ends, 24 ends or 12 ends, which draw from the inside, special orders are accepted for any number of ends up to 60. Roving can also be furnished on tubes which draw from the outside.

3. Fiber diameter is carefully controlled to an exceptional degree of uniformity throughout.

Yes, Pittsburgh Fiber Glass Roving is manufactured and packaged to meet your requirements for smooth production and better reinforced plastics. Our offices will be glad to provide complete information on our ability to serve you. Pittsburgh Plate Glass Company, Fiber Glass Division, 420 Fort Duquesne Boulevard, Pittsburgh 22, Pa. District Offices: Chicago, Cincinnati, Cleveland, Detroit, New York, Washington.

FIBER PG GLASS

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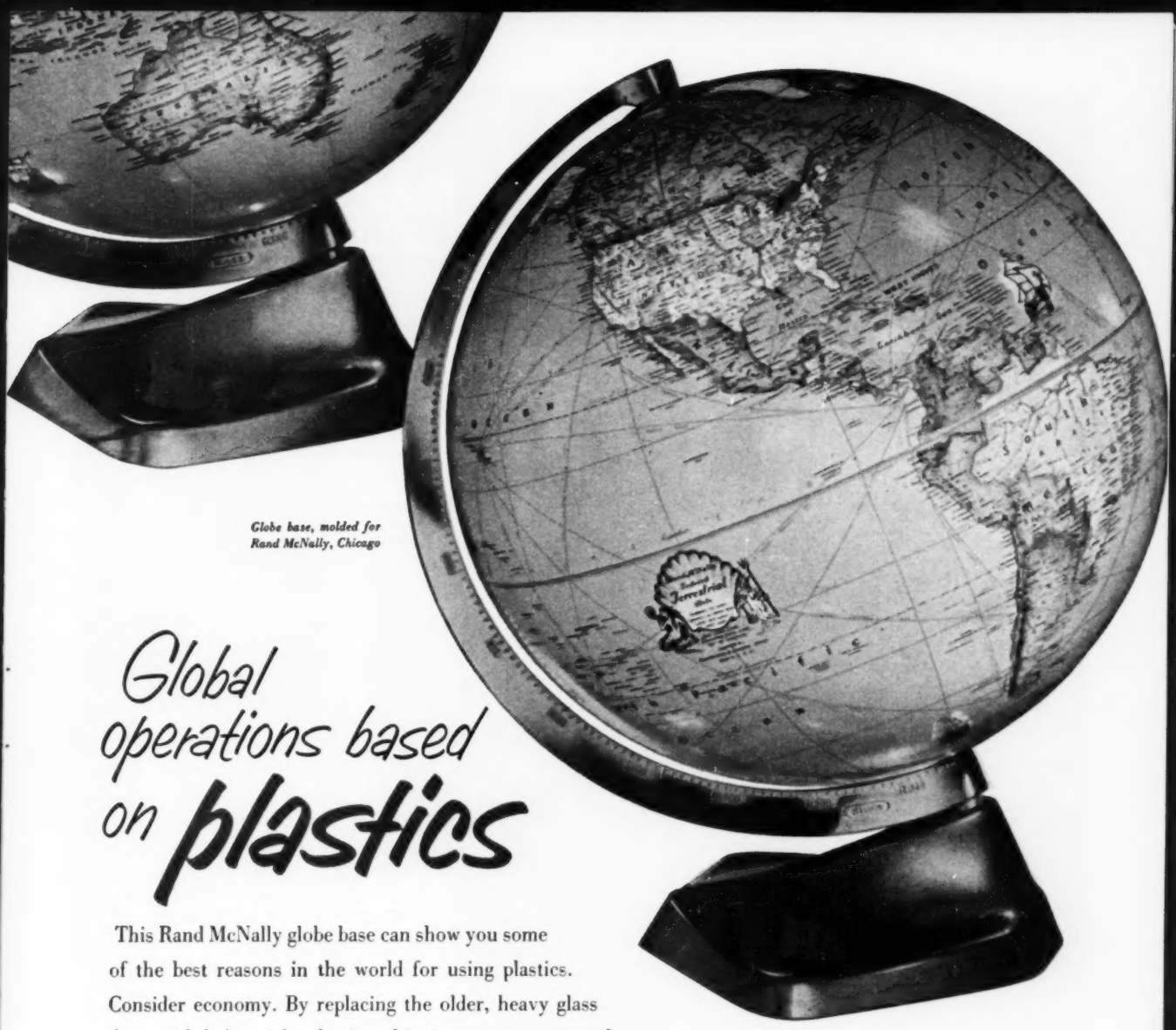
PITTSBURGH PLATE GLASS COMPANY



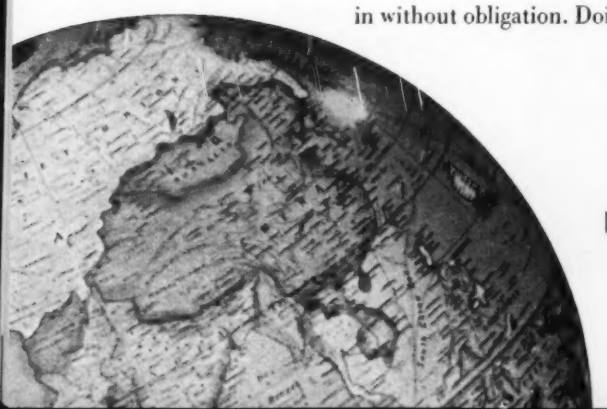
Globe base, molded for Rand McNally, Chicago

Global operations based on plastics

This Rand McNally globe base can show you some of the best reasons in the world for using plastics. Consider economy. By replacing the older, heavy glass base with lightweight plastic—shipping costs were greatly reduced without sacrificing durability. Think of appearance. Only correct design and careful molding could produce a piece with such a handsome metallic sheen without going to the great expense of painting and finishing required in other production methods.

Take another look at the base, noticing its graceful curves and contours. You will see another good reason why plastics was the most economically sound way to do the job.

Honest counselling—proper design, skillful molding enabled us to give Rand McNally a better product at actually lower cost. We would like to do the same for your product. Feel free to call us in without obligation. Doing it today may profit you tomorrow.



Write on your letterhead for the new Injection Molded and Extruded Plastics Catalog. Or, for detailed information about [redacted], piping, tubing and fittings, write for circulars containing data and illustrations.*

***Trade Mark Reg.**

ELMER E. MILLS CORPORATION

INJECTION MOLDED and EXTRUDED Thermo-Plastic Materials Including Cellulose Acetate, Cellulose Acetate Butyrate, Acrylates, Methacrylates, Styrenes, Vinyls, Vinylidene Chloride, [redacted]*

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a subsidiary of CONTINENTAL CAN COMPANY

Look to MPc for Material Evaluation when considering the use of Fiber-Glass Reinforced Plastics

Plastics reinforced with fiber-glass hold forth the most alluring prospects to product designers. Through the use of these versatile materials, the designer may be able to gain radical product improvements and at the same time effect substantial cost reductions.

How can these amazing materials be adapted to your specific requirements? What is the most suitable production technique... the most appropriate impregnating resin? **MPc** stands ready to help you find the best answers.

A working knowledge of impregnating resins in all their many formulations qualifies **MPc** to advise you in developing your specifications. **MPc** will make all necessary engineering calculations... mechanical, electrical or design application. Extensive laboratory facilities are yours to use for every type of test required for your product. And when your product has passed beyond the engineering stage, **MPc** offers unexcelled tooling and production facilities. Address your inquiry to MOLDED PRODUCTS, 4535 W. Harrison St., Chicago 24, Illinois.

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MEMBER: COMMITTEE ON LARGE PLASTIC MOLDINGS OF THE SPI

DE MATTIA INJECTION MOLDING MACHINES

DE MATTIA
MACHINE and TOOL CO

—FAMOUS FOR SUPERIOR PERFORMANCE!

INSTALL DE MATTIA for the kind of molding performance that places the emphasis on fast production and minimizes your rejects. In addition to advance design advantages, every De Mattia model is built rugged to assure smooth, dependable operation with a minimum of maintenance "down time". Ask for the facts on De Mattia equipment for the modern molding plant, today!

DE MATTIA TIME-AND-MONEY-SAVING FEATURES!

- **Exceptionally Heavy Tension Members**
- **High Mold Clamping Pressure**
- **Uniform Hydraulic Pressure On Entire Die Face**
- **Large Plasticizing Capacity**
- **Positive Heat Control**
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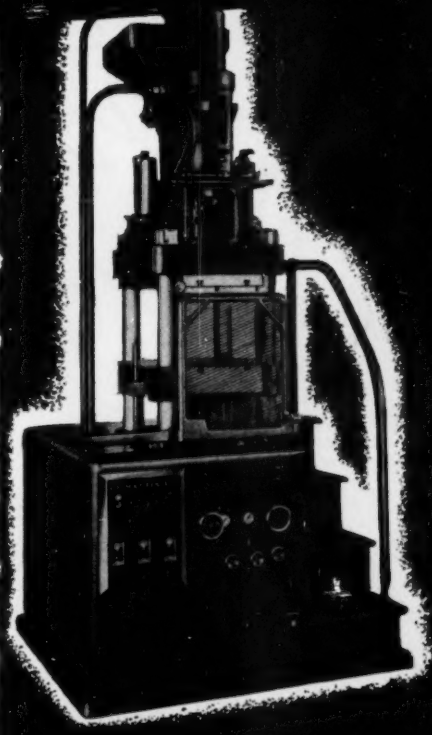
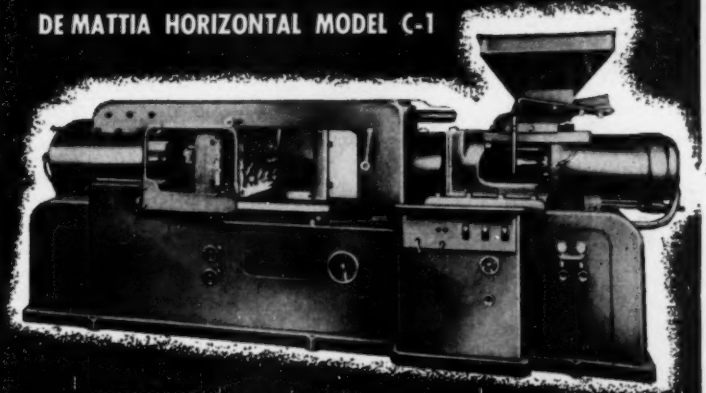


DE MATTIA VERTICAL MODEL G-1

SPECIFICATIONS

Ounces Molded per Shot — 4 (Styrene); Pounds of Plasticized Material per Hr. — 50; Capacity of Feed Hopper (Lbs.) — 50; Diameter of Injection Plunger — 1⅞"; Diameter of Hydraulic Injection Cylinder — 8½"; Pressure on Material — 20,500 lbs. per sq. in.; Size of Die Plates — 14" x 23"; Mold Opens — Stroke — 15"; Max. Daylight — 19"; Min. Die Space — 4"; Motor — 20 HP @ 1,200 RPM; Pump Capacity — 54 GPM @ 1,000 PSI; Mold Closing Pressure (Tons) — 150; Floor Space Required — 47" x 59" — Height Over All — 108"; Approximate Wt. of Machine (Tons) — 4¼; Injection Piston Stroke — 7¼"; Closing Cylinder Bore — 8 1/16"; Complete Injection Time (Max.) — 1.88 Sec.; Heating Cylinder — 4,350 Watts.

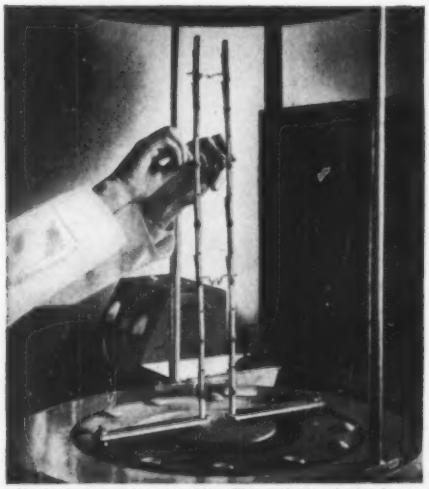
DE MATTIA HORIZONTAL MODEL C-1



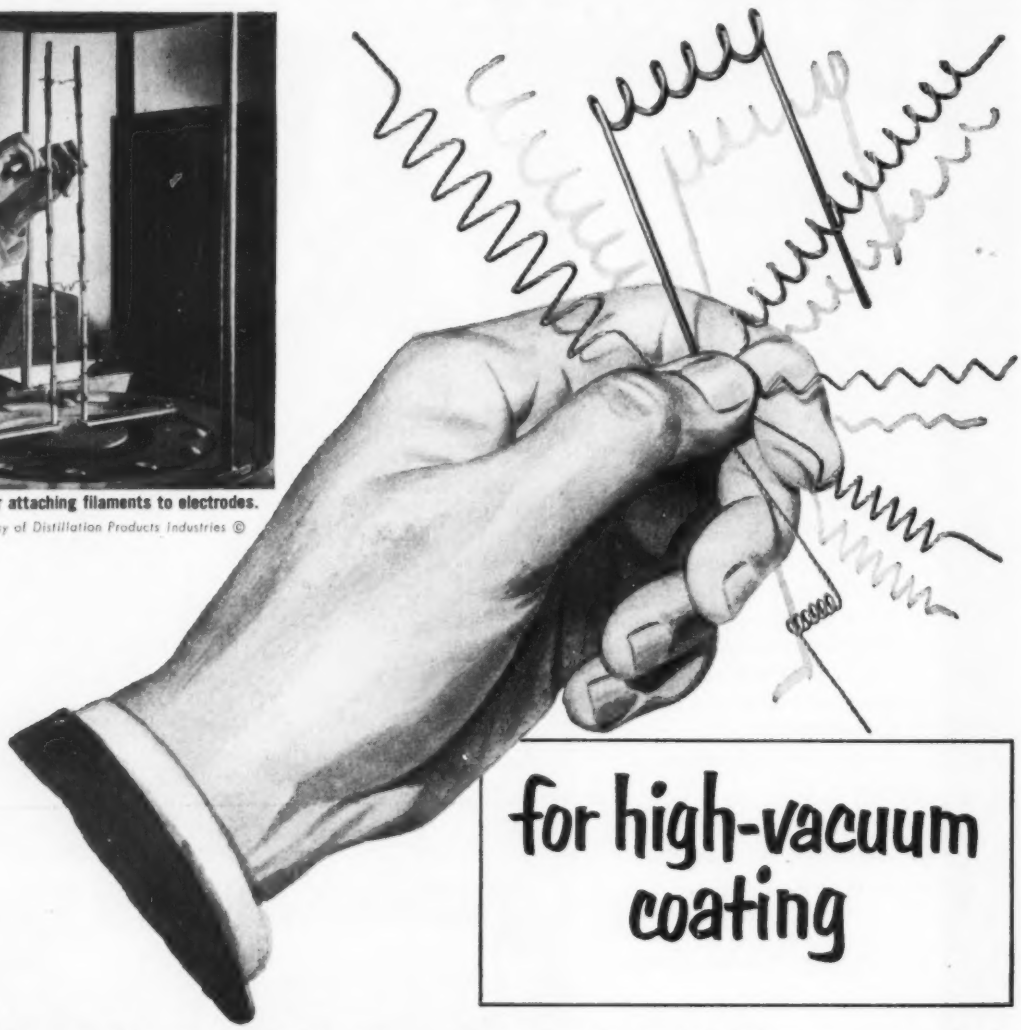
SPECIFICATIONS

Material per Injection — 12 ozs.; Plasticized Material per hour — 130 lbs.; Feed hopper Capacity — 60 lbs.; Injection Piston Diameter — 2¾"; Injection Piston Stroke — 11½"; Hydraulic Injection Cylinder Bore — 13"; Pressure on Material — 22,500 PSI; Mold Closing Pressure — 400 Tons; Max. Mold Size — 18" x 25"; Max. Daylight — 30"; Min. Die Space — 6"; Max. Stroke — 24"; Oil Pump Capacity — 60 GPM @ 1000 PSI; Max. Motor — 30 HP; Injection Stroke Time, for Filling Mold — 3.0 Secs.; Speed of Injection Piston, Forward — 120" per Min.; Heating Cylinder — 13,000 Watts; Height of Machine, Overall — 72"; Floor Space Required — 172" x 42"; Approx. Weight — 10 Tons.

Sylvania Tungsten Coils



Typical means for attaching filaments to electrodes.
Photograph courtesy of Distillation Products Industries ©



for high-vacuum coating

Sylvania custom made tungsten coils assure highest performance at lowest cost

Sylvania either has a tungsten coil or will design one for your particular need. We have the facilities and engineering know-how to supply you with the right coil for any job.

Here's why Sylvania Tungsten Coils save you money:

- You can count on certainty of operation in each cycle.
- They provide a uniform deposit of metal where you want it.
- They reduce mechanical breakage in loading of filaments.
- You get more shots from each filament and best heat for evaporation.

Sylvania offers a complete line of efficient ready made coils. Each of these high grade tungsten filaments is designed for a specific job. Each has the most efficient section and surface area to assure you excellent performance . . . at the lowest cost.

If you make your own tungsten coils, Sylvania can supply you with the highest quality tungsten wire—single or multiple strand, as well as expert design assistance.

For full information write for the free Sylvania Brochure 3T-5010, Sylvania Electric Products Inc., 1740 Broadway, New York 19, N. Y.

SYLVANIA

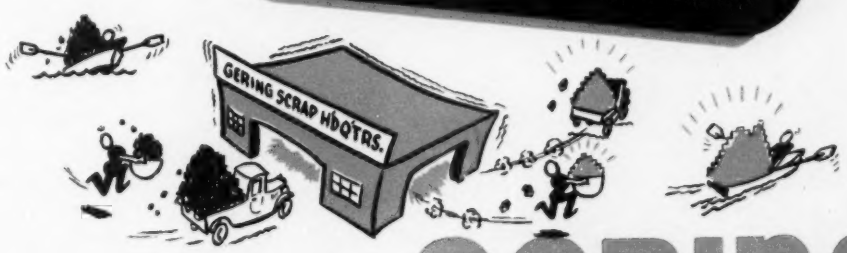
LIGHTING • RADIO • ELECTRONICS • TELEVISION

In Canada: Sylvania Electric (Canada) Ltd.
University Tower Building, St. Catherine Street, Montreal, P. Q.

MORE *than ever...*

plastic SCRAP *is not* WASTE!

Gering will buy your thermoplastic scrap, obsolete molding powders, rejects in any form . . . will reclaim and rejuvenate this valuable "scrap" into perfectly good molding powders . . . will sell you good reconditioned molding powders: Polystyrene, Cellulose Acetate, Ethyl Cellulose, Polyethylene, Butyrate, Vinyl, Acrylic. Nylon.



Examine your surplus and scrap inventories right now. This is your opportunity to get the most out of them!

GERING

Products Inc.

KENILWORTH, N. J.

THE WORLD'S LARGEST RECLAIMING FACILITIES

Another new development using

B. F. Goodrich Chemical *raw materials*

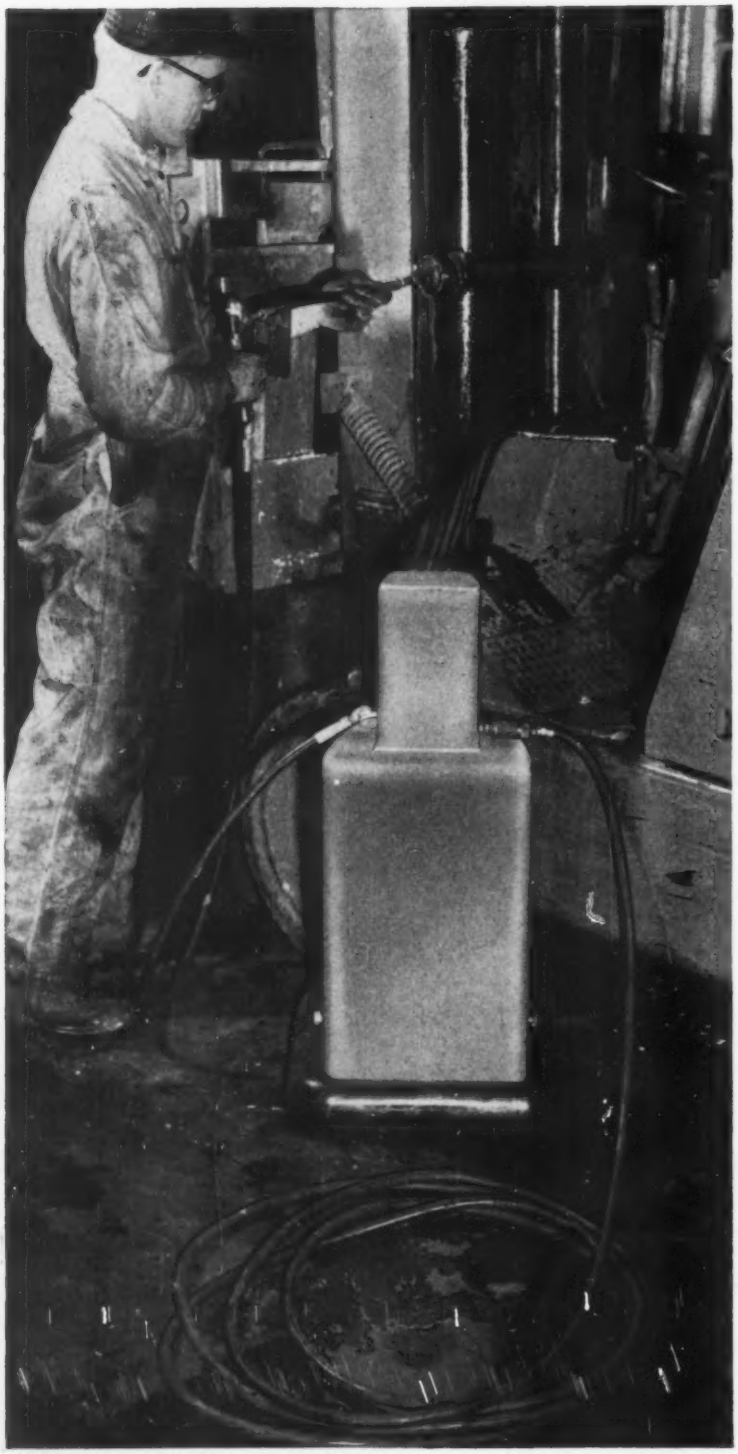


Photo and data courtesy of Thermoid Co., Trenton, N. J. B. F. Goodrich Chemical Co. supplies the Hycar rubber only.

Why this HYCAR hydraulic hose has a long and useful life

YOU can see in this picture some of the tough conditions this hydraulic hose, made with Hycar rubber, has to meet—and *does,* to perfection!

One of them is oil, particularly high-pressure lubricants. Another is grease, including compounded greases carrying metallic soaps. Still another is corrosion from battery acid. There are the deteriorating effects of gasoline, plus abrasion from rough handling or dragging around to contend with. And the Hycar hose must remain flexible.

Hycar rubber comes through on every count. For Hycar is resistant to *all* these destructive conditions and more, such as heat and cold, aging and many chemicals.

Perhaps one of the Hycar rubber compounds can do a better job for you, help you improve or develop more saleable products. We'll help with technical information. Just write Dept. HV-5, B. F. Goodrich Chemical Company, Rose Bldg., Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

B. F. Goodrich Chemical Company
A Division of The B. F. Goodrich Company

Hycar
Reg. U.S. Pat. Off.
American Rubber

GEON polyvinyl materials • HYCAR American rubber • GOOD-RITE chemicals and plasticizers • HARMON organic colors

Whatever

YOUR PRODUCTION PROBLEM, SOLVE IT

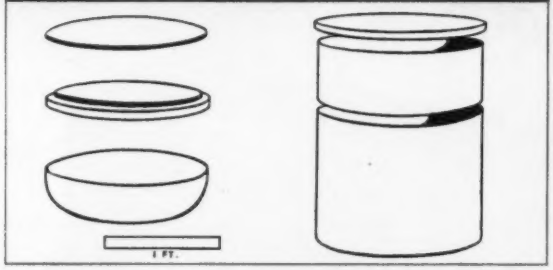
FASTER, BETTER, CHEAPER

WITH CHEMOLD COMPANY'S

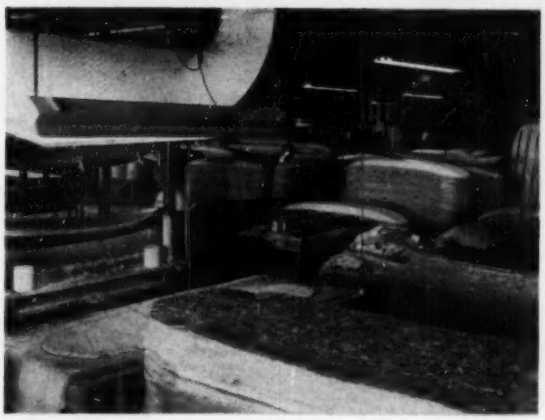
Matched Metal Mold Process

CUSTOM MOLDERS OF SHATTERPROOF GLASS-FIBER REINFORCED POLYESTER RESIN PRODUCTS

MOLDS ON HAND



The Chemold Company is equipped to turn out any polyester resin glass fiber products ranging from 32"x96" ribbed or flat translucent building panels, to other compound curvature shapes using Chemold's 250-ton presses.



Arctic Sleds Molded in One Operation

Above is one of a battery of giant matched metal mold presses capable of stamping out one reinforced glass-fiber Arctic Sled every 4 minutes for Armed Forces use.

Write for information today.

Got a Problem Product?
Chemold's Matched Metal Molds May Produce it FASTER, BETTER, CHEAPER

AT CHEMOLD COMPANY you may discover the answer to your manufacturing problems. For CHEMOLD offers you top-flight technical know-how, backed by largest matched metal mold press installation in the West. Perhaps one of our existing molds can be converted to your own use. If not, a special mold made at low cost for your own exclusive use may provide the solution you seek. May we be of service?

CHEMOLD COMPANY
2310 BROADWAY
SANTA MONICA, CALIF.

"LARGEST MATCHED METAL MOLD PRESSES IN THE WEST"

CHEMOLD COMPANY, DEPT. MP-10
2310 Broadway, Santa Monica, Calif.

☐ Send details on Matched Metal Mold Process.

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FIRM _____

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THE DOWDING AUTOMATIC *FAST-CYCLING*

INJECTION MOULDING MACHINE

Phenomenal Demand— Extends Manufacturing Programme!

- 1,200 CYCLES PER HOUR
- FULLY AUTOMATIC AND FOOLPROOF
- FAST PLASTICIZING AT UNUSUALLY LOW INJECTION PRESSURE
- AUTOMATIC LUBRICATION
- 3-ZONE CYLINDER HEATING
- VICKERS-DETROIT HYDRAULIC EQUIPMENT

BRITISH MADE

EARLY DELIVERY

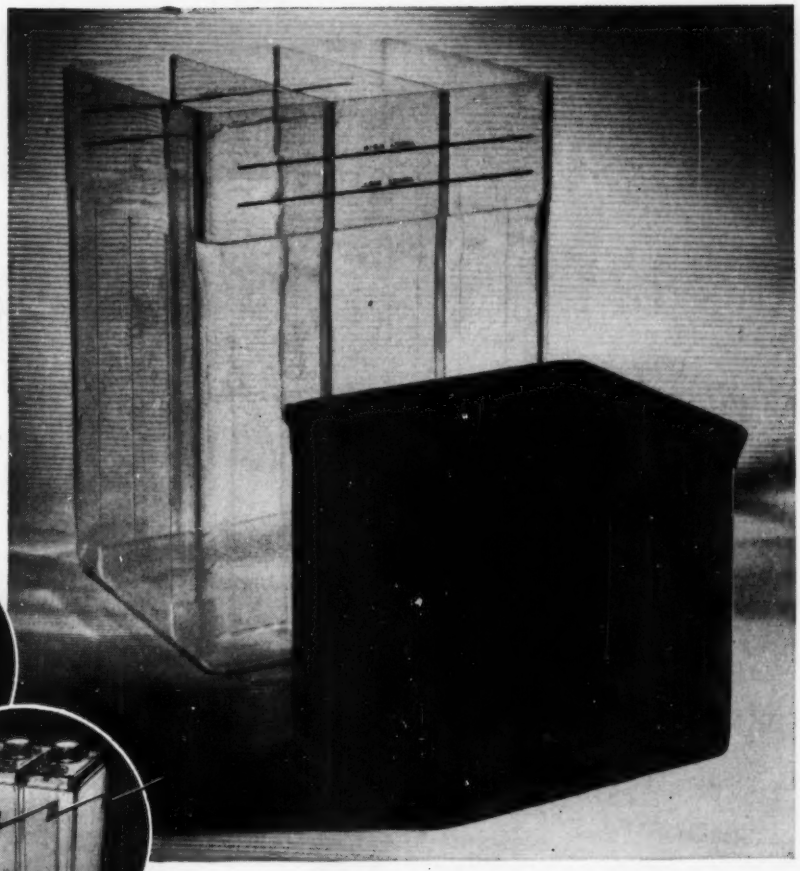
SPECIFICATION

MACHINE CYCLES PER HOUR (Max.)	1200
APPROXIMATE WEIGHT OF MATERIAL PLASTICIZED PER HOUR (Dependent upon weight per shot and material used)	22 lb.
Area of Injection plunger	2·074 sq. in.
Pressure per square inch on material at end of plunger	9100 lb.
Total pressure on Injection plunger	18,850 lb.
Mould opens (adjustable)	6-9 in.
Maximum die space	7½ in.
Minimum die space	3½ in.
Maximum recommended casting area in mould	15 sq. in.
Size of die plates	16 x 10 in.

DOWDING & DOLL LTD.

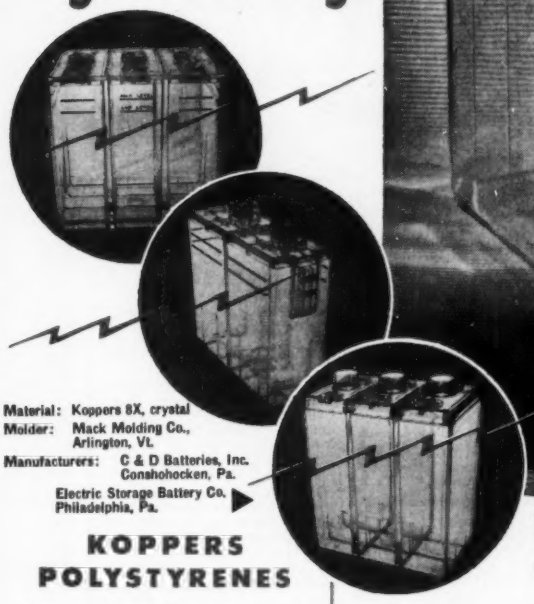
346 KENSINGTON HIGH ST., LONDON, ENGLAND. 'GRAMS: ACCURATOOL WESTERN LONDON

MORE POWER to your battery!



Material: Koppers 81, crystal
Molder: Prolon Plastics Florence, Mass.
Manufacturer: C & D Batteries, Inc., Conshohocken, Pa.

Material: Koppers MC-409
Molder: General American Transportation Co., Chicago, Ill.
Manufacturer: Gould National Batteries, Inc., Trenton, N. J.



Material: Koppers 8X, crystal
Molder: Mack Molding Co., Arlington, Vt.
Manufacturers: C & D Batteries, Inc. Conshohocken, Pa.
Electric Storage Battery Co. Philadelphia, Pa.

KOPPERS POLYSTYRENES

Type 3	General Purpose Polystyrene
Type 7	Improved Heat Distortion Temperature
Type 8	Highest Heat Distortion Temperature
MC-185	High Impact, Lowest Water Absorption Rate
MC-301	High Impact, Improved Heat Distortion Temperature
MC-305	High Impact, Easy Flow
MC-309	High Impact, Highest Heat Distortion Temperature
MC-401	Medium Impact, Improved Heat Distortion Temperature
MC-405	Medium Impact, Easy Flow
MC-409	Medium Impact, Highest Heat Distortion Temperature

KOPPERS POLYSTYRENES are helping to improve the efficiency and quality as well as life of modern batteries. Both regular and impact types of polystyrene have a high dielectric value, and high heat distortion temperatures which assure retention of shape and dimensions. They are nonporous, and are impervious to the effects of acids which are commonly used in batteries.

Koppers Modified Polystyrenes give auto and truck batteries the shock resistance that is always essential to good performance. In stationary batteries, where resistance to shock is not of prime importance, Koppers Regular Polystyrene offers the additional advantage of transparency.

Polystyrene's strength reduces breakage during shipment, and its light weight makes handling easier, cuts transportation costs substantially.

A Koppers representative will be glad to serve you in the application of Koppers Polystyrene to your battery problems. The unique combination of desirable characteristics and the eye appeal found in these thermoplastics can help you make a better battery.

Koppers Plastics Make Many Products Better and Many Better Products Possible.

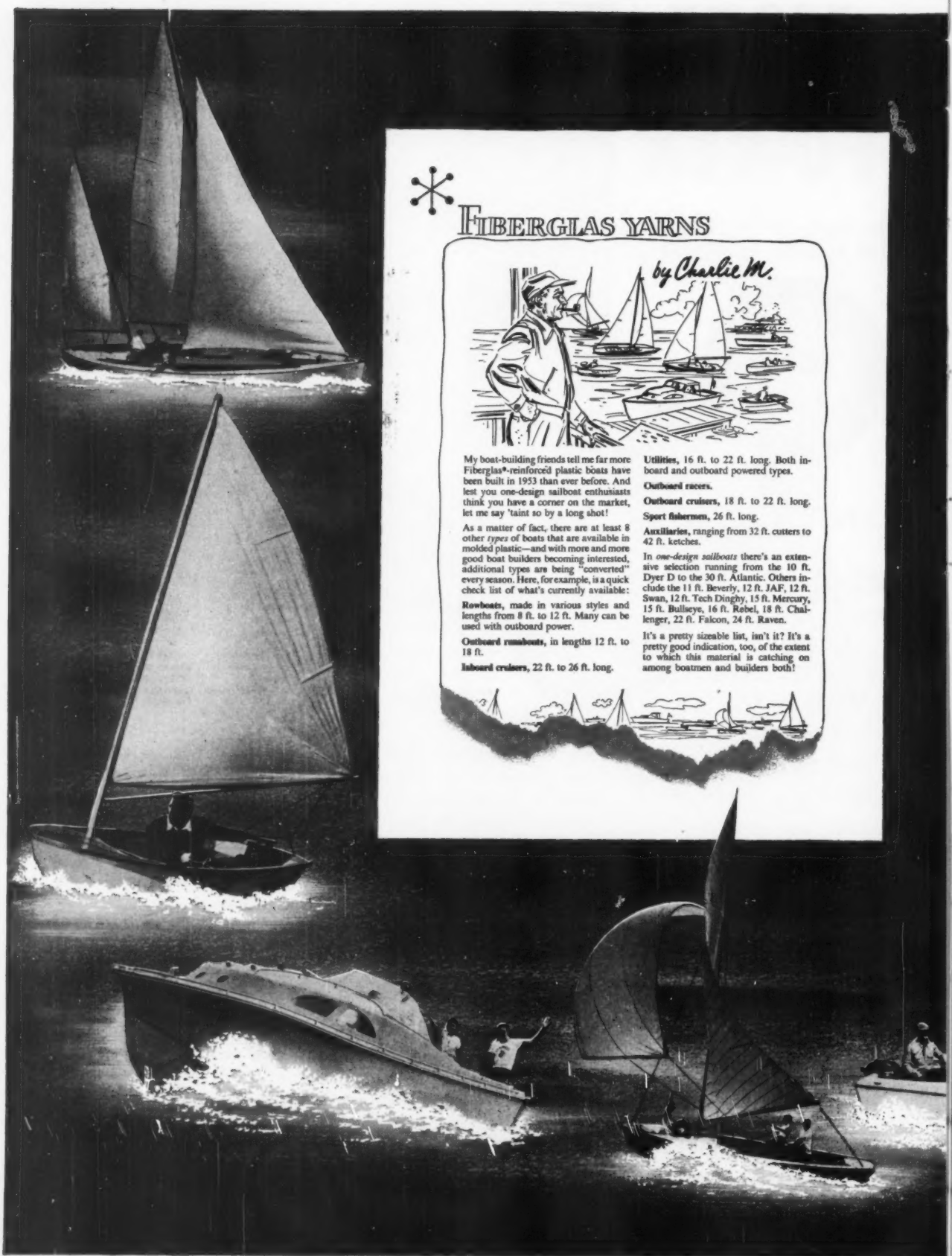
KOPPERS®

Koppers Plastics

Guaranteed by Good Housekeeping

KOPPERS COMPANY, INC., Chemical Division, Dept. MP-103, PITTSBURGH 19, PENNSYLVANIA

SALES OFFICES: NEW YORK · BOSTON · PHILADELPHIA · CHICAGO · DETROIT · LOS ANGELES



FIBERGLAS YARNS

by Charlie M.

My boat-building friends tell me far more Fiberglas®-reinforced plastic boats have been built in 1953 than ever before. And lest you one-design sailboat enthusiasts think you have a corner on the market, let me say 'taint so by a long shot!

As a matter of fact, there are at least 8 other *types* of boats that are available in molded plastic—and with more and more good boat builders becoming interested, additional types are being "converted" every season. Here, for example, is a quick check list of what's currently available:

Rowboats, made in various styles and lengths from 8 ft. to 12 ft. Many can be used with outboard power.

Outboard runabouts, in lengths 12 ft. to 18 ft.

Inboard cruisers, 22 ft. to 26 ft. long.

Utilities, 16 ft. to 22 ft. long. Both inboard and outboard powered types.

Outboard racers.

Outboard cruisers, 18 ft. to 22 ft. long.

Sport fishermen, 26 ft. long.

Auxiliaries, ranging from 32 ft. cutters to 42 ft. ketches.

In *one-design sailboats* there's an extensive selection running from the 10 ft. Dyer D to the 30 ft. Atlantic. Others include the 11 ft. Beverly, 12 ft. JAF, 12 ft. Swan, 12 ft. Tech Dinghy, 15 ft. Mercury, 15 ft. Bullseye, 16 ft. Rebel, 18 ft. Challenger, 22 ft. Falcon, 24 ft. Raven.

It's a pretty sizeable list, isn't it? It's a pretty good indication, too, of the extent to which this material is catching on among boatmen and builders both!

Best year ever

FOR FIBERGLAS*-REINFORCED PLASTIC BOATS

In the boating field, one thing's for sure—the yen among boatmen everywhere for boats built of Fiberglas-reinforced plastics is getting stronger by leaps and bounds.

In 1953, for example, more plastic pleasure craft have been built—built better, built bigger—than ever before. And industry leaders agree 1954 will bring an even greater surge forward in sales.

To the molders, resin makers and boat builders with whom Owens-Corning Fiberglas has shared the excitement of helping to pioneer this fascinating new field, hearty congratulations.

And to the many folks in the industry who have spoken kindly of the OCF-sponsored "Fiberglas Yarns" series appearing regularly in leading boating magazines, sincerest thanks. Helping to promote new markets in this fashion can be every bit as important a phase of cooperative effort as is the sharing of the fibrous glass industry's most extensive research facilities and production know-how.

OWENS-CORNING FIBERGLAS CORPORATION
Textile Products Division, 16 East 56th Street, New York 22, N. Y.

*As adapted from FIBERGLAS YARNS, a series of advertisements appearing regularly in such leading boating magazines as YACHTING and MOTOR BOATING. The series is sponsored by Owens-Corning Fiberglas Corporation as an aid toward increasing the understanding and use of Fiberglas-reinforced plastics among boating enthusiasts everywhere.

*Fiberglas is the trade mark (Reg. U. S. Pat. Off.) of Owens-Corning Fiberglas Corporation for a variety of products made of or with fibers of glass.

anywhere in this solar system

Colorful Spaceman equipment is an absolute must among the small fry. Every child in the neighborhood solar system is in urgent need of interplanetary flight equipment to prepare for imminent solar activity. Toy stores feature plastic helmets, weapons and flight aids in brilliant eye-appealing colors.

TITANOX titanium dioxide white pigments contribute brightness, brilliance and opacity to these fast-selling plastic items, and to the grown-up products as well. TITANOX pigments are applicable to any type of plastic, although special TITANOX pigments may be required to secure certain desirable properties. Consult the Technical Service Department for assistance in obtaining the maximum benefit from titanium dioxide pigmentation. Titanium Pigment Corporation, 111 Broadway, New York 6, N. Y.; Atlanta 2; Boston 6; Chicago 3; Cleveland 15; Los Angeles 22; Philadelphia 3; Pittsburgh 12; Portland 9, Ore.; San Francisco 7. In Canada: Canadian Titanium Pigments Limited, Montreal 2; Toronto 1.

TITANOX® *makes plastics brighter*

®TITANOX

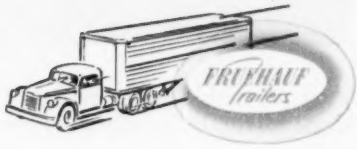
the brightest name in pigments

TITANIUM PIGMENT CORPORATION

Subsidiary of NATIONAL LEAD COMPANY

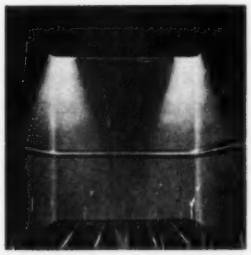
1709

Putting New Light on an old problem!



How Fabricon Custom Molded Plastic "Windows" Simplify load handling in Fruehauf Trailers!

Fruehauf builds the new "Road★Star" trailers *big!* Builds 'em *long*, too. So long, in fact, that the interior would be quite dark, were it not for the material used to form the forward roof corners. It's versatile fiberglass-reinforced polyester, custom molded by Fabricon . . . and this translucent material "daylights" the entire forward end of the trailer, making possible substantial time savings during loading and unloading. What's more, these plastic "windows" are durable . . . take buffeting from low-hanging branches far better than any metal previously used on the corners. Yet translucency and strength are but *two* of the properties you obtain with Fabricon fiberglass-reinforced plastics! Other benefits include: ● Light weight ● Ease of cleaning ● Brilliant, permanent color ● High corrosion resistance ● Choice of textures ● Heavier design of cross sections when required. Let our extensive background in plastics research, product design, tooling and production shed some light on *your* next problem, too! Our presses and preform equipment can take care of all of your fiberglass molding requirements, regardless of size or shape. Send parts, prints, or details of your problem for prompt engineering recommendations and a firm quotation.



Fabricon fiberglass-reinforced plastic moldings bring a double bonus . . . extra visibility and added durability . . . to users of "Road★Star" trailers. In spite of the trailer's depth, its entire forward end is amply lighted. This is accomplished through the use of transluscent molded fiberglass to form the peak, or forward roof corners. The fiberglass molding also stands up under frequent buffeting from low hanging tree branches, far better than did any metals tried for this application. Stands up so well, in fact, that its use is now being considered for other trailer parts, including the entire roof!

FABRICON PRODUCTS, INC.

Plastics Division

Main Office: 1727 West Pleasant Ave., River Rouge 18, Michigan
Manufacturing Plants: River Rouge, Los Angeles
Sales Offices: New York, Chicago
Canadian Representative: Plastic Supply Co., Montreal and Toronto

NOTE: Fabricon is the world's largest producer of plastic-impregnated materials for the laminating industry under the trade name "Phenopreg." Phenopreg pre-impregnated fibreglass fabrics and mats are separate and distinct from the fiberglass materials used in our molding division.

RUGGED, LOW COST AIR CYLINDER WITH BUILT-IN VALVE SETS NEW STANDARDS FOR FAST, PRECISION OPERATIONS

Built-in electrical operating controls, built-in 4-way valve, built-in dual piston rod speed regulators, all with a single air connection, simplify installation of economical pneumatic circuits.

Any repetitive push, pull or lift movement now done manually can be performed infinitely faster, safer, and at lower cost with this unique, electrically-controlled Bellows Air Motor. The range of work it can do is limited only by the imagination of the tool designer or production engineer.

Unlike conventional air cylinders which require separate remote valves and cumbersome piping, The Bellows Air Motor is a complete power unit. It is compact, fits into crowded quarters, on moving machine elements. It is fast, responds to a starting impulse instantly. It is safe. Its low voltage operation simplifies wiring. It is sturdy, records of 10,000,000, 15,000,000, even 30,000,000 cycles without maintenance or repairs are commonplace.

The Bellows Air Motor is made in a wide range of mounting styles; in five bore sizes to meet varying power requirements; and in standard stroke lengths up to 48". For mechanical or manual operation the Air Motor can be equipped with a built-in manual valve, or for operation in explosive-hazardous areas with the built-in explosion-proof electrically controlled valve.

The Bellows Air Motor gives you an entirely new conception of the productive possibilities of air power. In the thousands of manufacturing plants where it is in use, it is establishing daily new records for cost reduction and improved productive efficiency. In metal working, in plastics, in woodworking, in any industry you can name, these versatile power units are sparking the imagination of cost conscious production men looking for ways to do old and new jobs better.

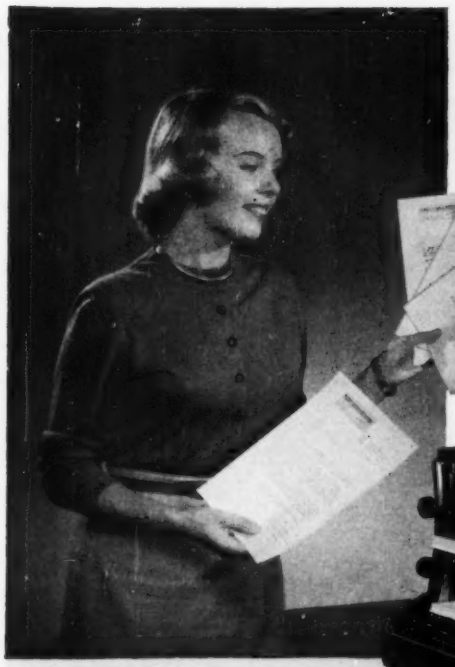
WRITE FOR THIS FREE 36-PAGE BOOKLET

THE STORY OF "CONTROLLED-AIR-POWER"—HERE IN THESE QUICK-READING PAGES IS WHAT IT IS DOING FOR OTHERS — WHAT IT CAN DO FOR YOU. THERE IS NO COST, NO OBLIGATION. ADDRESS: DEPT. MP-1053, THE BELLOWS CO., BELLOWS BLDG., AKRON 9, OHIO. ASK FOR BULLETIN CL-50.

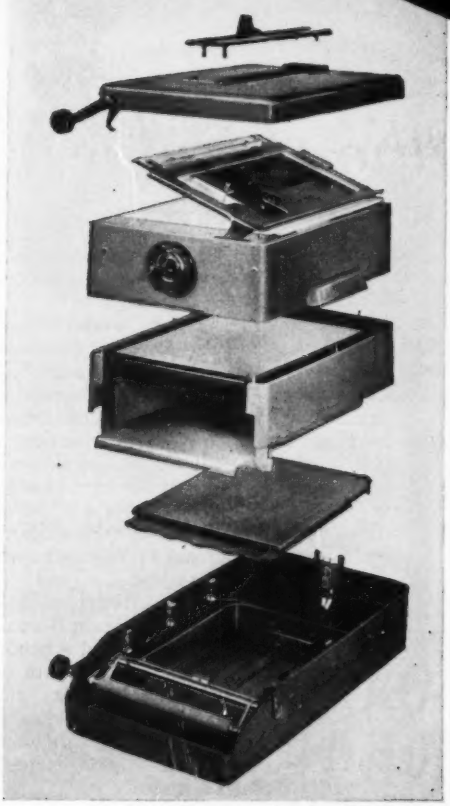
The Bellows Co.
AKRON 9, OHIO

1664-1

BELLOWS "CONTROLLED-AIR-POWER" DEVICES FOR FASTER, SAFER, BETTER PRODUCTION



Plastic Facts about KODAK VERIFAX PRINTER



by ERIE

Pioneer in Custom Molded Plastics

Eastman Kodak Company's Verifax Printer is a notable achievement in the simplification of photographic reproduction of letters and other material, and in reduction in the cost of duplication. The Verifax Printer is also a notable achievement in intricate mold design and plastic molding.

Of the six major components the most complicated are the paper cabinet and the printer body. The cabinet has an average wall thickness of 0.156" and has alignment lugs molded into top and bottom to facilitate assembly with other components. The printer body, which rests on the cabinet, has 20 holes molded into the body to contain the electric light sockets. It is one of the heaviest complicated moldings yet done in modified styrene.

Erie, the pioneer in custom molded plastics, is still the pioneer in extending the boundaries of the possible in plastic molding.

25th Anniversary ERIE TRADE MARK

Write for your copy of bulletin, "Who We Are . . . What We Do in Plastics."

ERIE RESISTOR CORPORATION . . . PLASTICS DIVISION

Main Offices: **ERIE, PA.**

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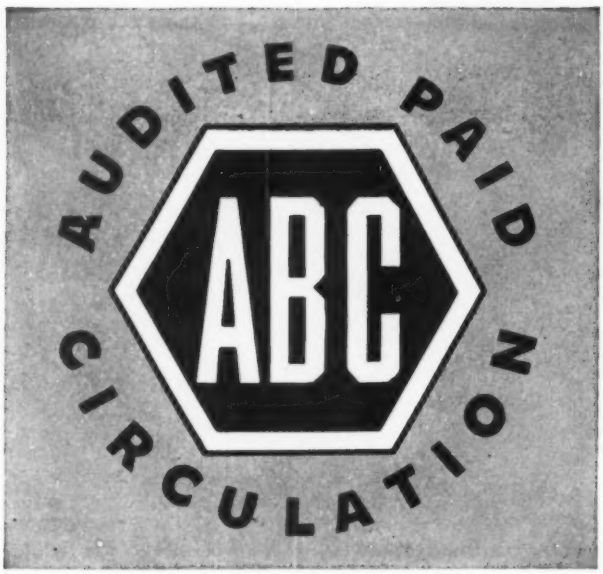

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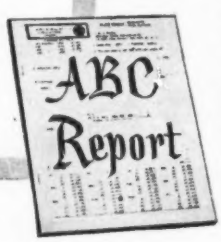
Subscription and renewal orders, payments from subscribers, paper purchases, postal receipts, arrears are among the publisher's circulation records that are painstakingly checked by auditors and the resulting data are condensed and published in A.B.C. Reports.

Experienced space buyers use the audited information in A.B.C. Reports as a factual basis for their decisions in evaluating, comparing and selecting media. The FACTS in A.B.C. Reports for business publications include: • How much paid circulation • How much unpaid distribution • Occupational or business breakdown of subscribers • Where they are located • How much subscribers pay • Whether or not premiums are used • How many subscribers in arrears • What percentage of subscribers renew.

SEND THE RIGHT MESSAGE TO THE RIGHT PEOPLE

Paid subscriptions and renewals, as defined by A.B.C. standards, indicate an audience that has responded to a publication's editorial appeal. With the interests of readers thus identified, it becomes possible to reach specialized groups effectively with specialized advertising appeals.



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MODERN PLASTICS

A.B.C. REPORTS—FACTS AS A BASIC MEASURE OF ADVERTISING VALUE

For precision and versatility—choose
OWENS-ILLINOIS for PLASTICS

For example—
Fitments for metal containers (spouts and caps for aerosol shaving soap)
For example—
Fitments for glass nursery bottles
For example—
Cosmetic containers
For example—
Specialty items—Tire valve and battery caps

Owens-Illinois packaging know-how and high-quality standards offer you the *finest* in molding plastic facilities . . . Injection molding . . . Compression molding . . . A complete range in plastics for packaging, for specialties.

Plastics Division — Owens-Illinois

OWENS-ILLINOIS GLASS COMPANY, TOLEDO 1, OHIO ***Branch offices:***

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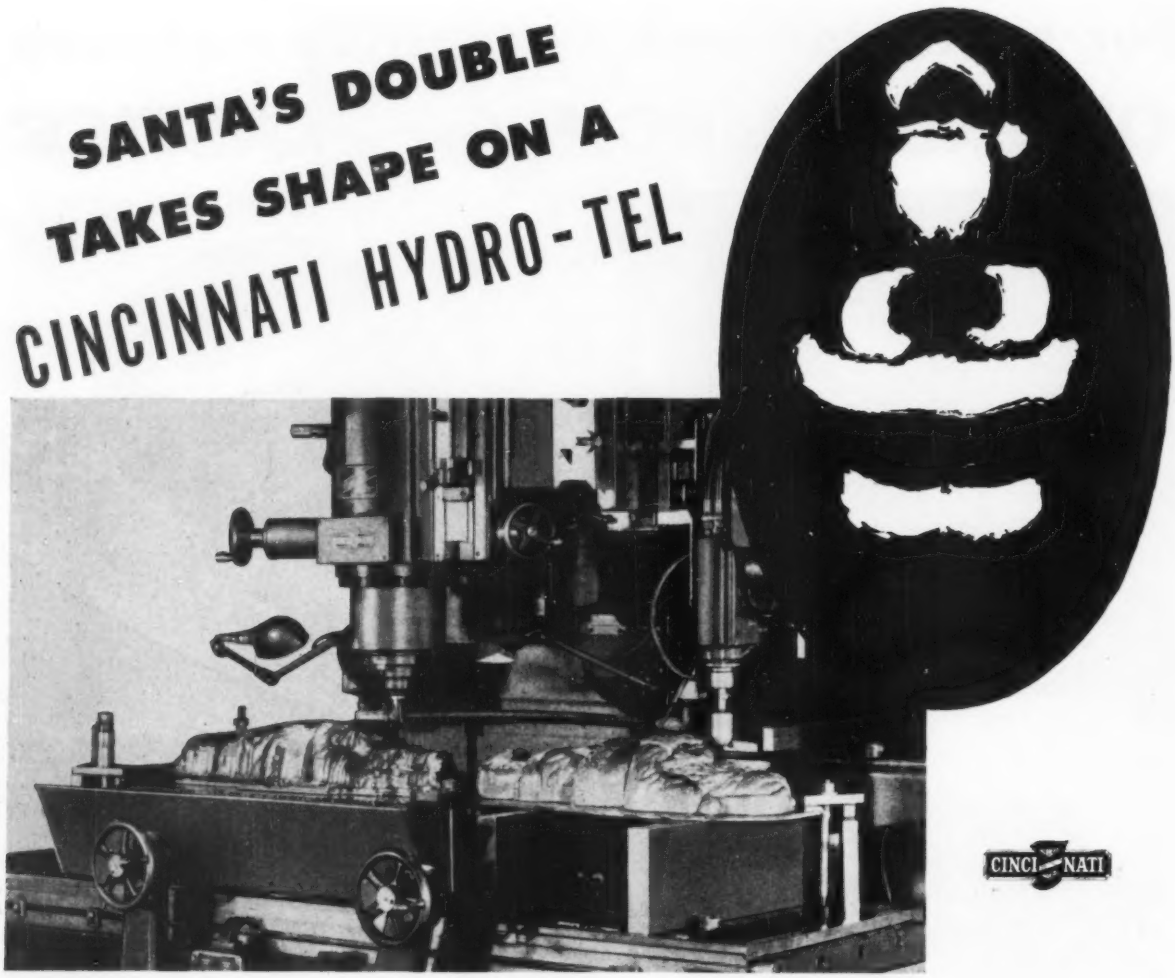
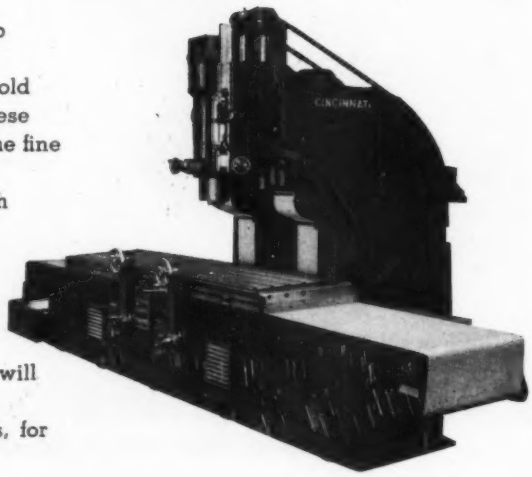
SANTA'S DOUBLE TAKES SHAPE ON A CINCINNATI HYDRO-TEL



You can see all kinds of molds take shape quickly and true to form under the guiding finger of CINCINNATI Hydro-Tel Type Milling Machines. An example is illustrated above . . . a mold for plastic Santa Clauses, partially completed on one of these machines. ¶Accurate duplication of face, whiskers, and all the fine details of a high-quality low-cost mold is accomplished *automatically* through Hydro-Tel's automatic hydraulic depth control unit. It responds to a few ounces pressure, and the cutter head goes immediately and precisely in the same direction, up and down, to mill a shape exactly like the master. This is a big advantage for tool and die shops . . . plaster and hardwood masters can be employed; tedious bench work on the mold is greatly reduced. ¶Our factory representatives will be glad to tell you how CINCINNATI Hydro-Tel Type Milling Machines can produce high-quality low-cost molds, for medium to large size plastic parts. May we hear from you?



THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

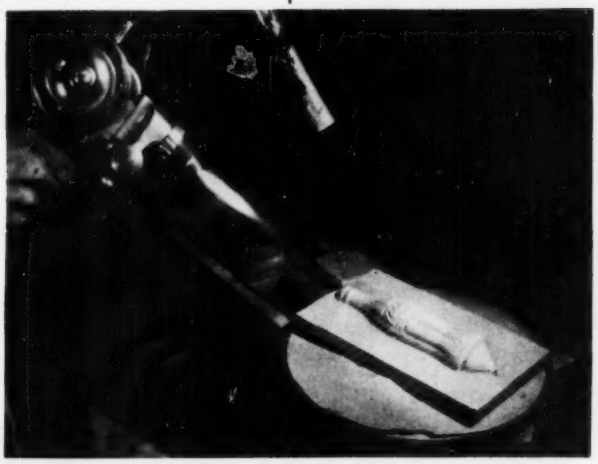
CINCINNATI 28" Vertical Hydro-Tel Milling Machine. Complete information may be obtained by writing for catalog M-1773. Brief specifications in Sweet's Machine Tool Catalog.

CINCINNATI

MILLING MACHINES • CUTTER SHARPENING MACHINES • BROACHING MACHINES • METAL FORMING MACHINES • FLAME HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

molds made in minutes

by fast, low-cost metallizing process



For low-pressure, vacuum, slush and lay-up molding.

Metallizing, the spraying of molten metal, is now being used for the production of molds for low-pressure, vacuum, slush and lay-up processes, in a wide range of mold sizes—some lay-up types as much as 30 feet long. These metal molds are made quickly, at low cost; masters may be of metal, cloth, wood, plastic, glass, or even wax. Finest detail is retained and mold life is practically indefinite. Part spoilage, "break-out" and patching or other maintenance on lay-up molds are eliminated; improved heat transfer, better curing, assure void-free parts.

Metallizing gun building up metal mold directly on plaster master

Finished mold. Note fine detail. Spraying time 28 minutes.

MODERN PLASTICS article describes method

The article, "SPRAYED METAL MOLDS," by *Dr. Walter Brenner* and *Leopold Hase*, of Brooklyn Polytechnic Institute, which appeared in the September MODERN PLASTICS, described the process in detail. We will be happy to send you a reprint of this article on request. Use the handy coupon.

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38-14 30th Street LONG ISLAND CITY 1, N. Y.
In Great Britain: METALLIZING EQUIPMENT COMPANY, LTD., Chobham near Woking, England

Don K. Watson
METALLIZING ENGINEERING CO., INC.
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☐ Please send me free reprint of MODERN PLASTICS article: "SPRAYED METAL MOLDS."

☐ Please have Metco Field Engineer call.

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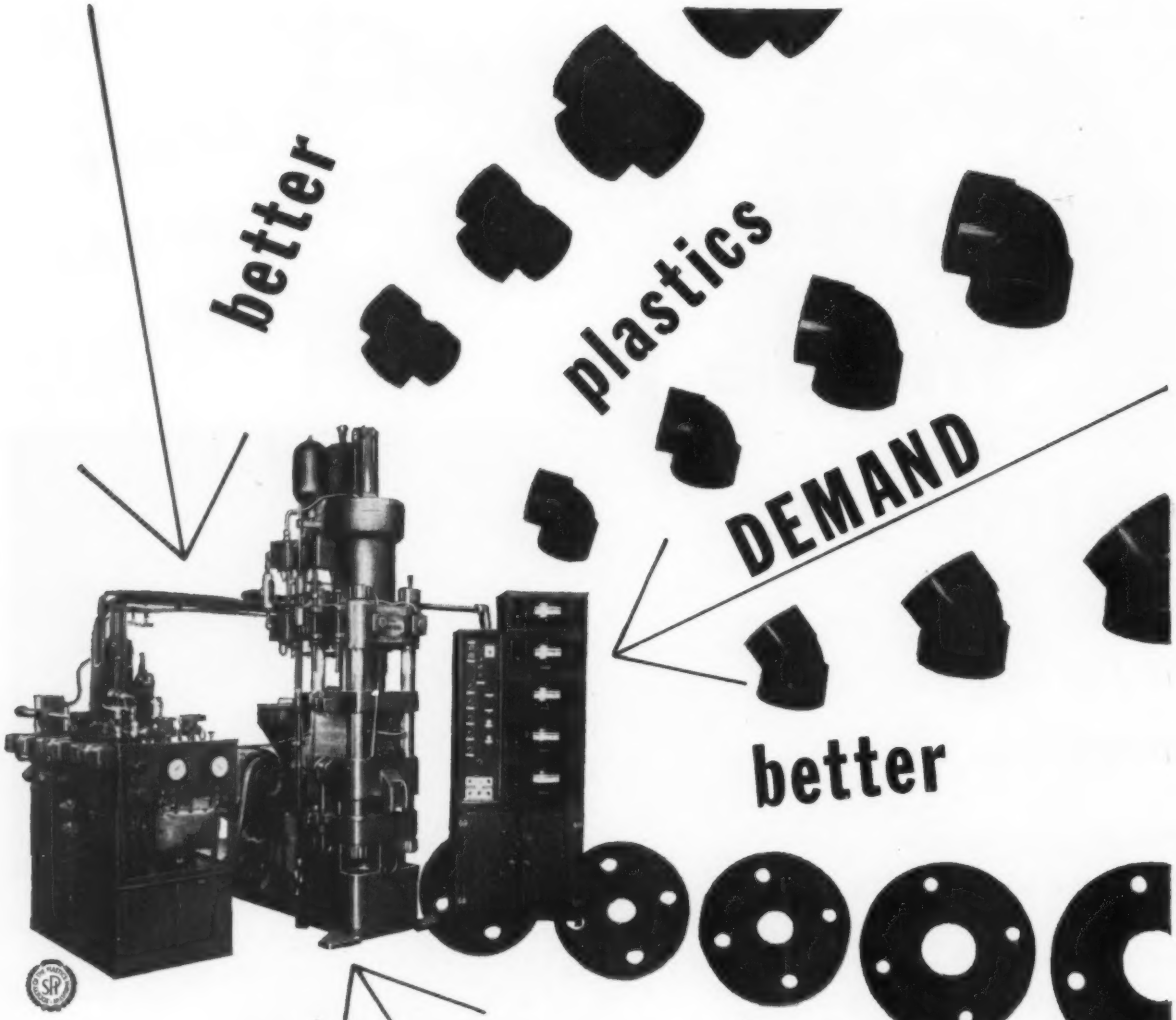

New plastics are opening new fields for injection molding . . . presenting new and difficult conditions which must be met. Jackson & Church is meeting the challenge with injection presses engineered to take up where conventional equipment leaves off.

J-C presses featuring the Hendry Pre-plasticizing System have successfully molded new and difficult-to-mold plastics including rigid polyvinyl chloride. Pipe fittings offering high corrosion resistance, high impact, strength and the ability to withstand exceedingly high pressures are now being molded commercially from new and tougher materials.

No machining after molding is necessary . . . fittings come out of the mold finished and threaded. It's little wonder that rigid polyvinyl chloride products made on J-C presses are replacing those made with conventional metals.

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Glidden leadership in pigment research offers material manufacturers, compounders of new or old materials, plastic molders, or coaters a combination of advantages found in no other Red or Yellow pigments. These colorants in Glidden CADMOLITH Colors make your coloring job easier—give finest, most lasting colors in powders or plastic products made from them.

SEND FOR THIS FOLDER giving complete details, with color chips. Write The Glidden Company, Chemicals • Pigments • Metals Division, Union Commerce Building, Cleveland 14, Ohio.

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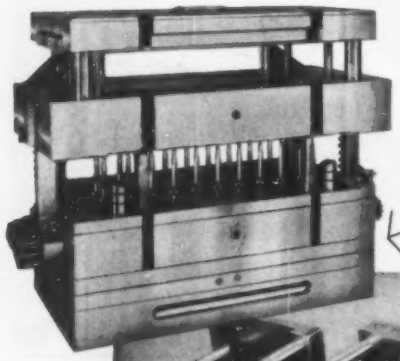
ANOTHER PROBLEM IN PLASTICS MOLDING SOLVED BY *J.G.TILP. INC.*

THE PROBLEM

To construct a mold for fountain pen barrels that would:
.. eliminate a seam on the thread
.. incorporate pin-point gating
.. accomplish ejection within a limited 10″ stroke



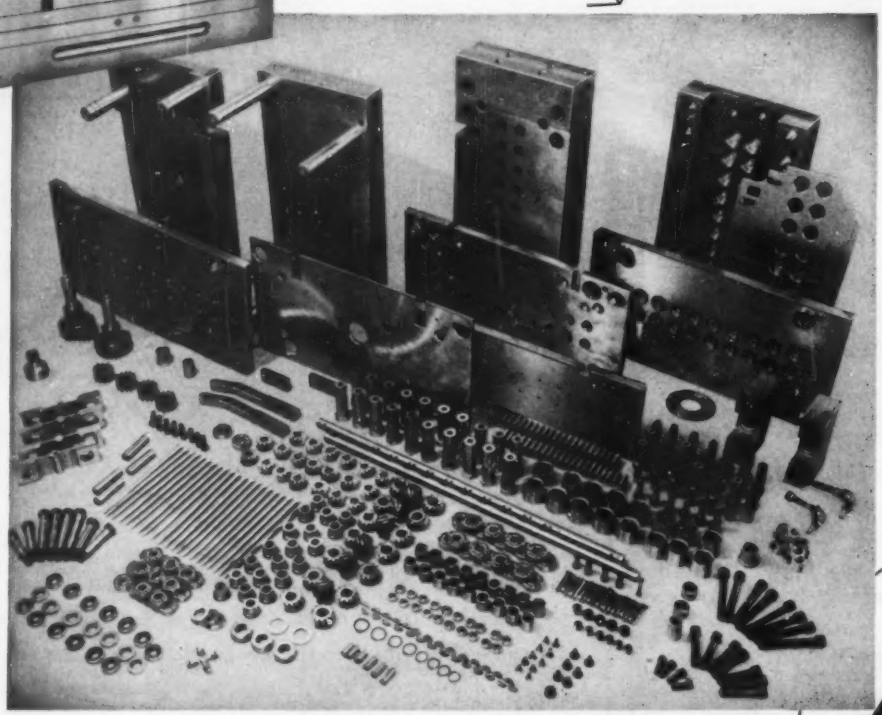
THE SOLUTION

A self-contained automatic unscrewing mold with special air injection, consisting of over 500 parts

HERE'S THE **J. G. TILP** MOLD, THAT DID THE JOB

ASSEMBLED

DISASSEMBLED



AND HERE'S THE FINISHED **PEN BARREL**

J. G. Tilp, Inc. can construct the mold that will solve *your* problem in plastics molding. Call on us. Address inquiries to the attention of Robert F. Tilp

J. G. TILP INC.

MANUFACTURERS OF INJECTION, COMPRESSION & TRANSFER MOLDS

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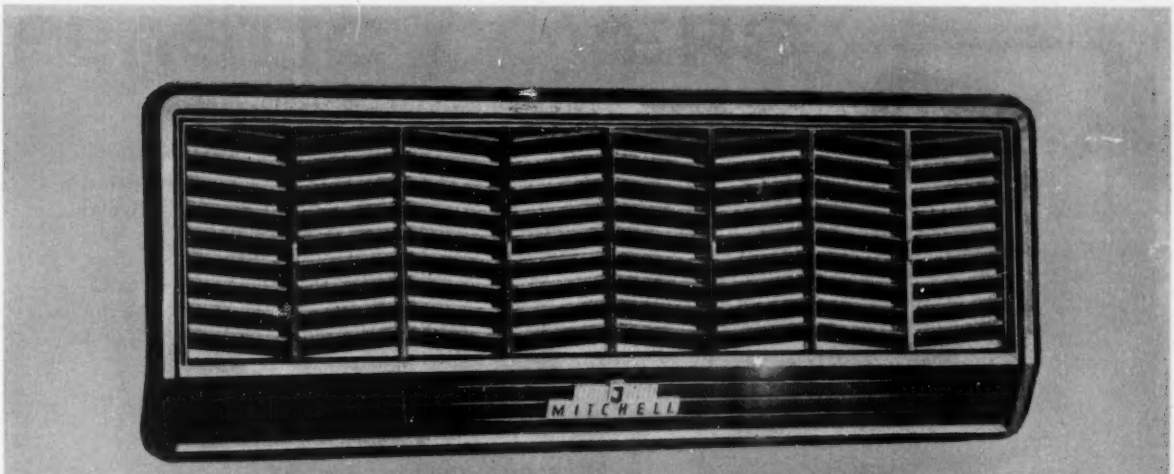
Mailing Address Box 554, Union, N. J. **UN**ionville 2-7300



Air conditioner movable louvers and frame molded by Chicago Molded Products Corp., Chicago, Ill.

"FOUR SEASONS" SERVICE

From a Four-Way Grille of BAKELITE PHENOLIC PLASTICS

TRADE-MARK

The Mitchell "Four Seasons" room air conditioner can work the year round . . . it cools air in summer, warms it in winter.

Its four movable louvers and their frame are molded of BAKELITE Phenolic Plastics to match this all-round service. They can be turned to direct the air in four directions. Frequent handling for adjustments won't hurt them. Heat, cold, and moisture won't affect their shape. Their colors are molded in—there's no applied finish to chip or peel. Their fine, clean lines reflect the efficient design and performance of the unit.

The name plate and concealed splash ring are also molded of BAKELITE Phenolic Plastic—demonstrating that this material can range from the purely decorative to the highly utilitarian. It is resistant to chemicals, oil, grease, vibration. It has excellent electrical properties when required. It comes in a variety of types to fit many different jobs.

These features of BAKELITE Phenolic Plastics may cut your production problems, bring more sales. Learn how they can be applied. Bakelite Company engineers will help. Write Dept. RU-13.

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PHENOLIC PLASTICS

TRADE MARK

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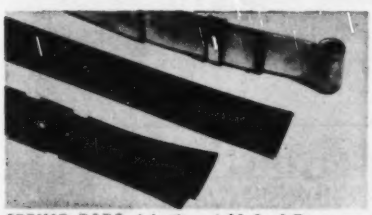
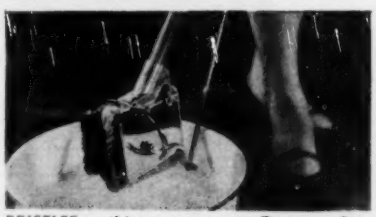
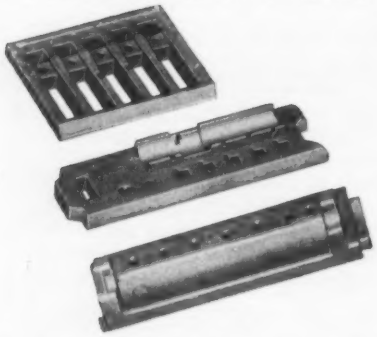


SPRING PADS, injection molded of BAKELITE Polyethylene, separate spring leaves, keep dirt out, prevent metal contact. Give long service at low cost. Made by Spring Perch Co., Lackawanna, N. Y.

SALAD SERVICE molded of BAKELITE C-11 Plastic resists salad oil, fruit juices, washing in hot water. Production costs are low. Has good finish, impact strength. Made by Jim Robbins Co., Royal Oak, Mich.



BRISTLES on this sponge mop are BAKELITE Styrene Plastic monofilaments that retain stiffness, withstand soap and detergents, won't curl. Dirt can't penetrate. Made by Buff Products Co., Fort Chester, N. Y.

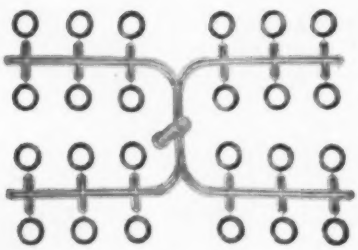


Precision

TV TUNER COMPONENT—Compression molded of alkyd for excellent electrical characteristics, low moisture absorption and dimensional stability. The alkyd has a short cure time . . . sets up fast . . . has the advantage of a short molding cycle with resulting economy of fewer cavities per mold and lower tooling costs.

Strength

SHIELD FOR CLOCK RADIO—Compression molded in general purpose phenolic. Wall has sufficient strength not only to protect the mechanism from damage, but to guard against electrical shock.



Uniformity

BATTERY SEALING GROMMETS—Injection molded of polyethylene. Tolerances were critical to insure finished parts that would give complete seals on every battery. The thin section of the grommet made it unusually difficult to hold the tolerances . . . finished parts had to be completely free of flash.

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These components are typical of the results you can get from Mallory Plastics' complete design, mold making and production facilities. Our engineers are well qualified to help you select the right material for the job . . . engineer and build precision molds . . . maintain production schedules that will match yours. Mallory Plastics' facilities include injection, transfer and compression molding equipment in a wide range of machine capacities. For complete information, write or call us today.

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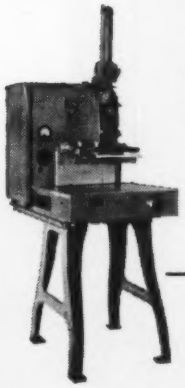
THERMATRON welds, doesn't stitch, plastics in a matter of seconds, producing durable, non-tearing seams that are stronger than the material itself... and no special skill on the part of the operator is needed. Ideal for the production of vinyl plastic ring binders, check book covers, telephone book covers, catalog covers and *hundreds* of other plastic items.



With THERMATRON's low cost, high speed production method, electronic sealing of your plastic items will be the doorway to new markets and bigger profits. Let's talk over your problem *now* without obligation . . . And write for our latest Bulletin No. 77.

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You have a free hand in formulation when you use Atlac LV, since it contains no styrene. You can mix it with styrene in any proportions you like . . . you can vary the ratio to obtain the optimum characteristics in your particular product. Usually no additional equipment is required; you mix resin in the same tanks you use for adding filler, pigments or catalyst.

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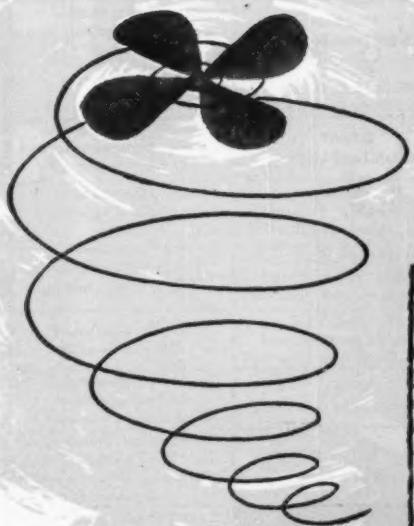
Write or call Atlas today for complete information.



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ATLAC LV . . . for low-viscosity laminating solutions in room-temperature or matched-metal-die molding applications.

ATLAC 382 . . . for ore-impregnating glass fiber cloth or mat, and for dry or putty type glass-filled molding compounds.

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ATLAC 370 . . . low-solubility binder for mat and pre-form production.

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"Dutch Boy" Stabilizers

PRODUCT	USE
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TRIBASE E (Basic Lead Silicate Sulphate Complex)	Low volume cost insulation
DS-207 (Dibasic Lead Stearate)	Stabilizer-lubricant for sheeting, film, extrusion and molded compounds
PLUMB-O-SIL A (Co-precipitate of Lead Orthosilicate and Silica Gel)	Translucent and colored sheeting and upholstery stocks
PLUMB-O-SIL B (Co-precipitate of Lead Orthosilicate and Silica Gel)	Translucent and colored film, sheeting, belting
PLUMB-O-SIL C (Co-precipitate of Lead Orthosilicate and Silica Gel)	Highly translucent film and sheeting
DYTHAL (Di-basic Lead Phthalate)	General purpose stabilizer for heat and light. Good electrical properties
DYPHOS (Di-basic Lead Phosphite)	Outstanding for heat and light in all opaque stocks, including plastisols and organosols
	As stabilizer or co-stabilizer in vinyl flooring and other compounds requiring good light-stability
BARINAC (Barium Ricinoleate)	Stabilizer-lubricant for clears

Asbestos filler is important in the making of high grade vinyl flooring. To use it satisfactorily, the industry has turned to "Dutch Boy" Normasal.

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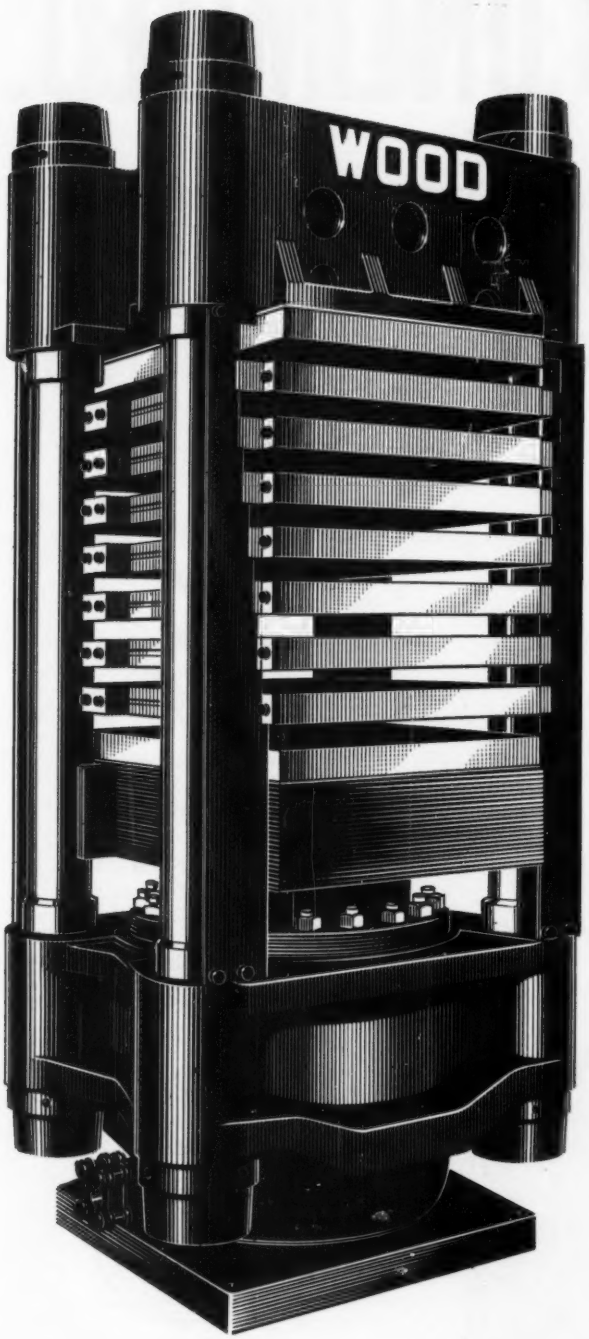

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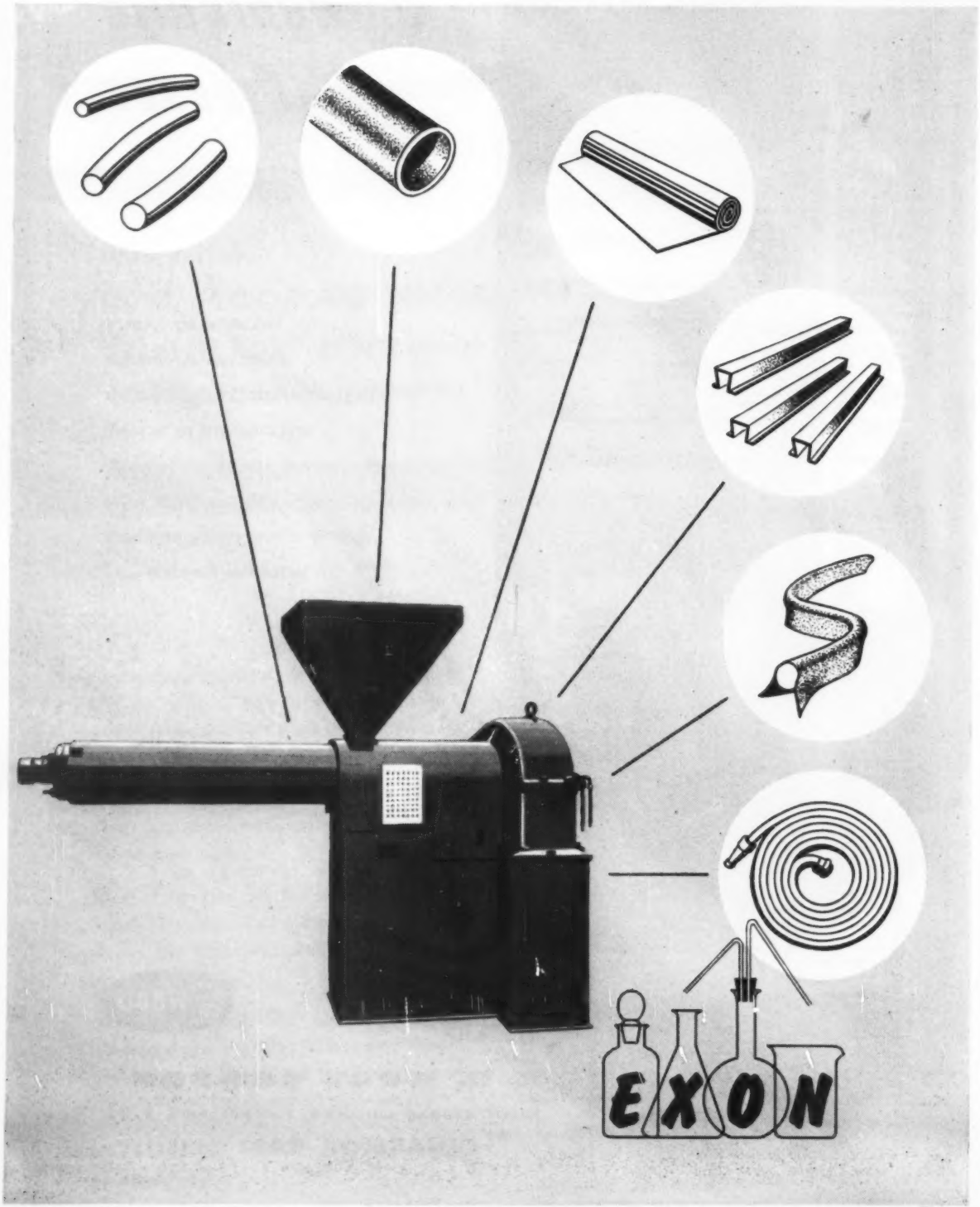

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Extrusions as exacting as best quality garden hose are achieved with Exon 915. As an end product, it has all the desired clarity, physical toughness and resistance to aging and moisture that make your product more salable.

Exon 905's exceptional versatility makes it the choice when the ultimate in physical properties is desired.

Exon 925 is indicated when compounds are used that are low in plasticizer content and are difficult to extrude.

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- **Extremely rapid blending**
- **Shorter fusing time**
- **Freedom from "fisheyes"**

So many manufacturers who used to have temperature problems are proving the efficiency and economy of Exon resins, it would pay you to investigate how their many benefits can help you, too.

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EXON 905 Excellent for film and sheeting applications where higher temperatures (up to 375° F.) are called for.	White Powder	1.40	2.50	0.45
EXON 915 High-versatility, resin specially designed for sheeting. Wide range of operating temperatures.	White Powder	1.40	2.30	0.45
EXON 925 An excellent P. V. C. resin for low processing temperatures. (starting at 275° F.)	White Powder	1.40	2.05	0.45

For further information on Firestone's complete line of high quality EXON resins... or for the assistance of Firestone's Technical Service, call or write:

CHEMICAL SALES DIVISION
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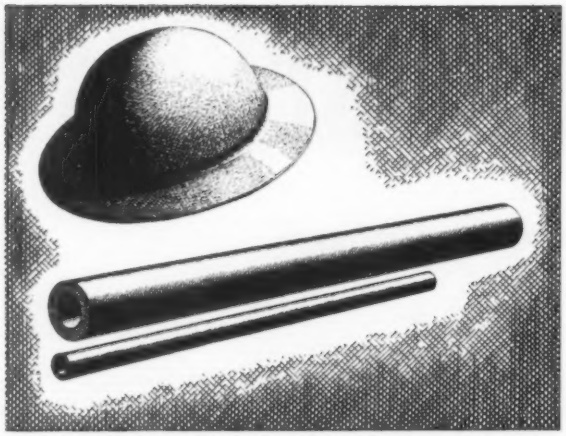
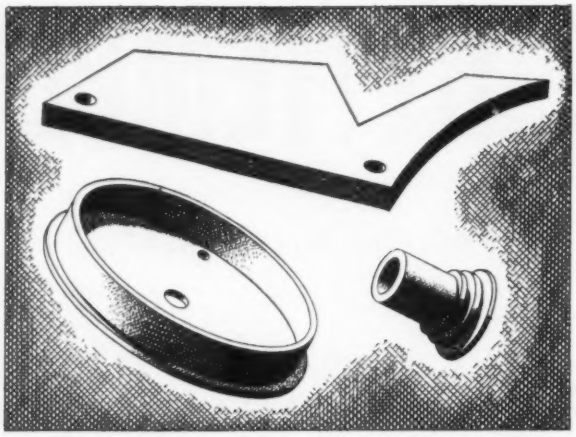
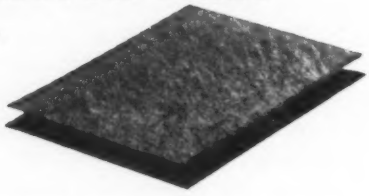


Wellington Sears ducks have the right weight and rugged, hard-gripping texture to make excellent reinforcements for C grade laminates.



Widely used in the electronic and high frequency fields, Wellington Sears spun nylon fabric insures high bonding strength and superior insulation resistance.

YOU GET BALANCED STRENGTH WITH WELLINGTON SEARS "LANTUCK"



Lantuck is a specially developed non-woven fabric which has achieved remarkable acceptance for laminating applications. Because of its completely random distribution of fibers, Lantuck gives laminates equal strength in all horizontal directions and exceptional machineability at high cutting speeds. It is an economical filler for fine gears, textile bobbin heads and other uses involving sharp projections or edges, mirror-like machined surfaces and superior mechanical strength.

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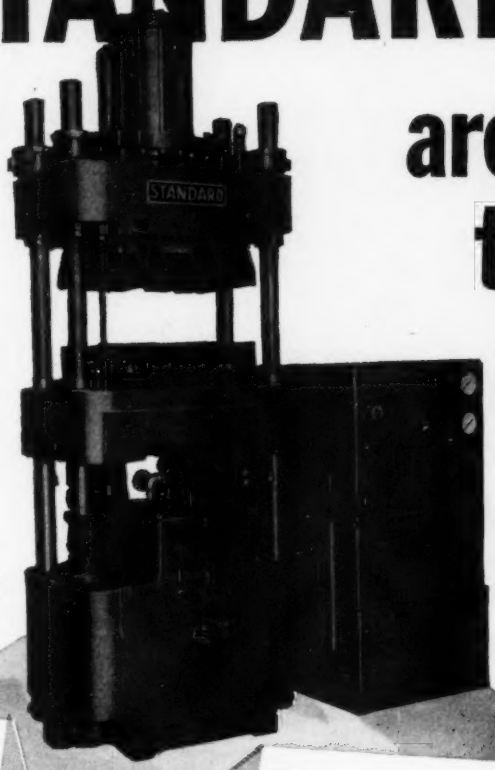

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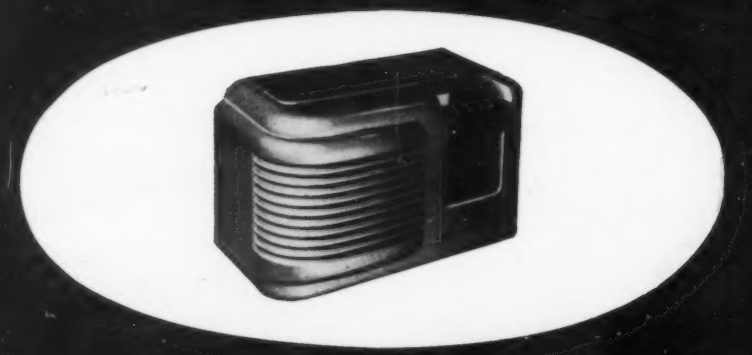

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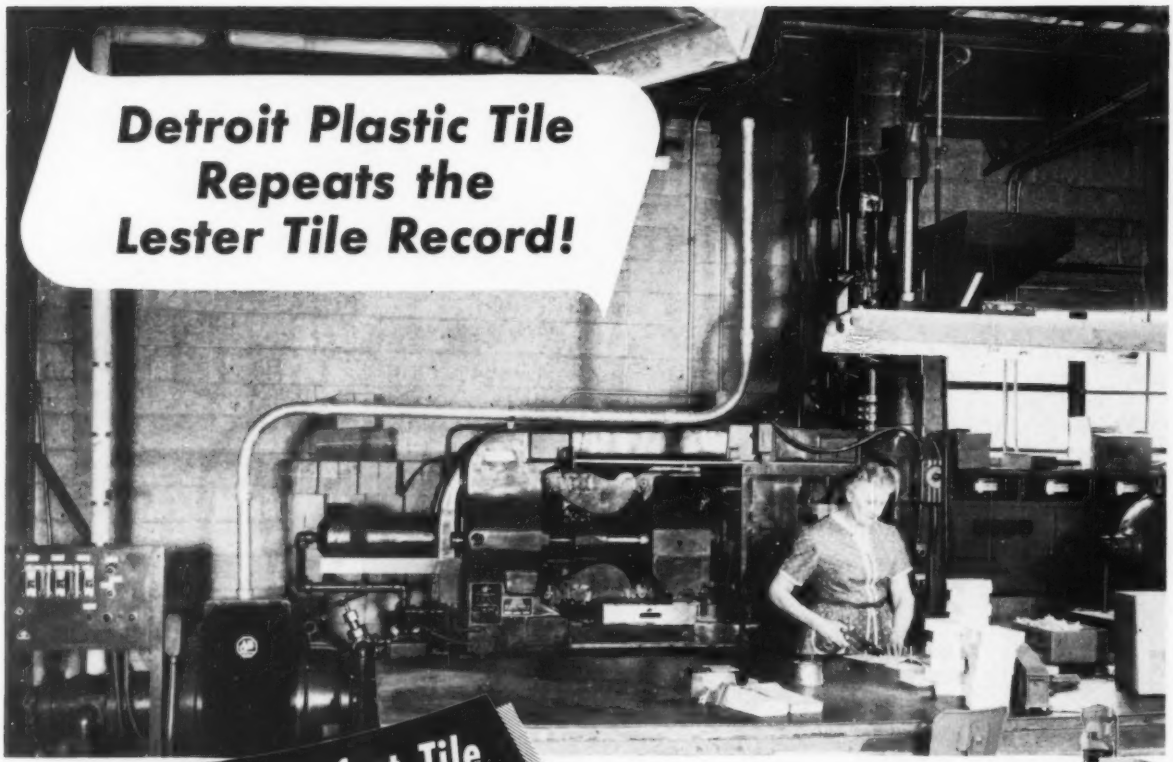

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Now, the 20 ounce Lester costs up to $10,000 more than an 8 oz. machine. You can see that you would have the cost differential returned in little more than 10 months and then the machine would be earning an *extra* $1000 per month!

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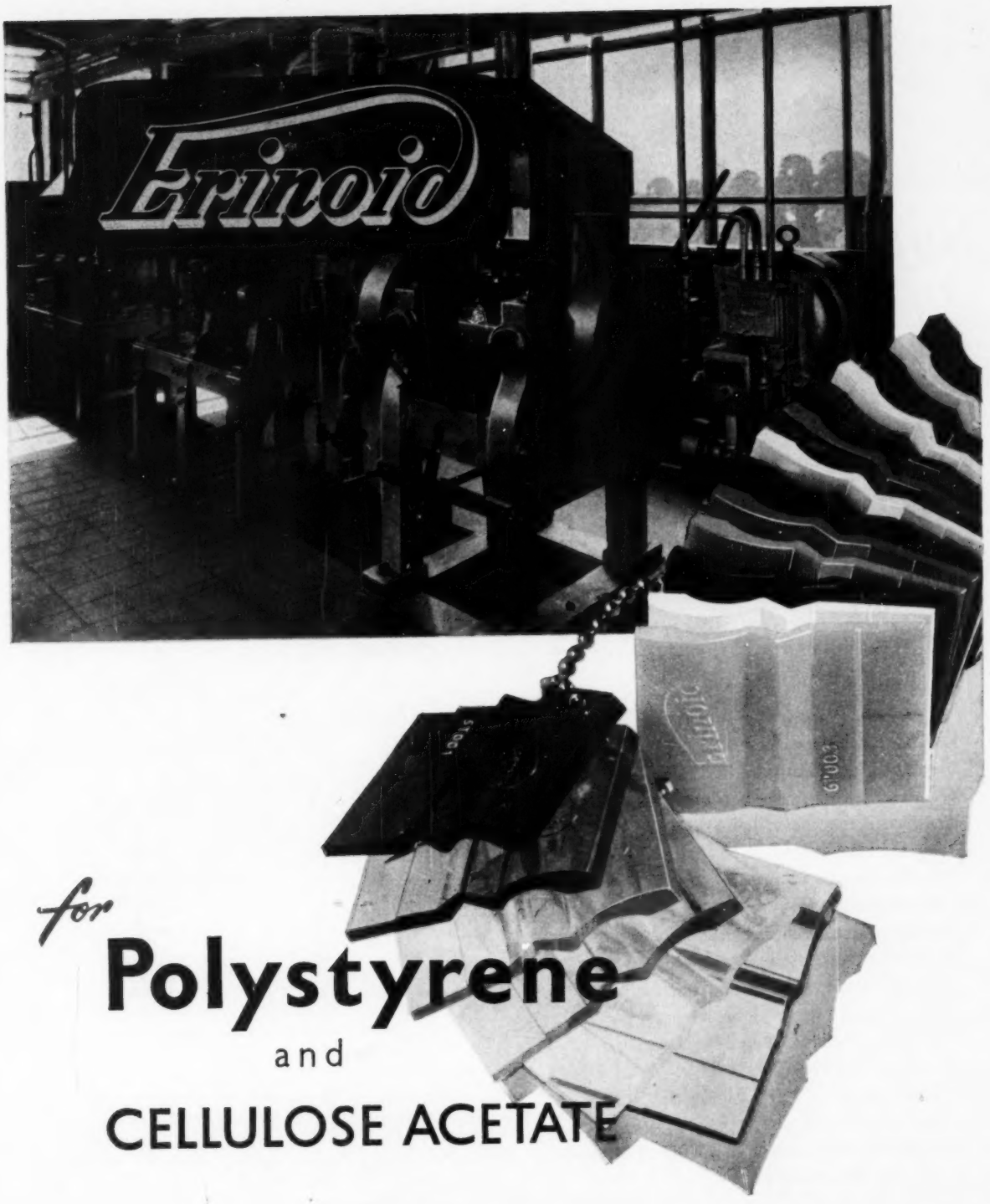

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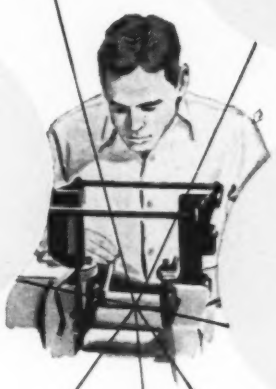

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MODERN PLASTICS

Background for developments in the sphere of sprayed-on plastics is found in "Operation Mothball." At left a gun mount on a deactivated fighting ship is protected from the elements by a spraying process. A vinyl web is sprayed over a framework of tape; this will be covered by spraying a film-forming formulation of liquid vinyl over the solid webbing

Official U. S. Navy photograph

NEW JOBS FOR SPRAYED-ON PLASTICS

Exciting new applications hold promise of fantastic possibilities as materials and techniques are perfected

LIQUID sprayable plastics that turn into web-like and film-like elastomeric solids on contact with air are the raw materials for a whole new group of industries.

Since "Operation Mothball" for the spray-wrapping of airplanes for open-deck shipment during World War II and anti-corrosion storage of inactivated fighting ships after the war, much research has been done on sprayed-on plastics and on methods of using them. The results of that research are now being put to practice in a number of exciting applications. Future possibilities as envisioned today border on the fantastic.

The application of web, film, or sheeting by spraying now appears to offer new product manufacturing techniques. Out of the new processes and materials formulations are coming products that range from lamp shades to building partitions and include furniture, roof surfaces, and packaging. These relatively new plastics materials and the techniques and tools wherewith they are applied present a new opportunity for the continuing expansion of plastics markets.

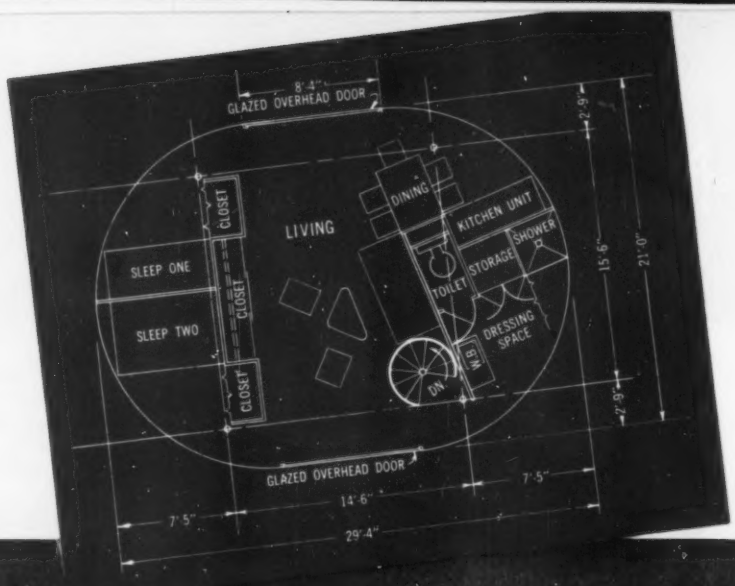
Materials

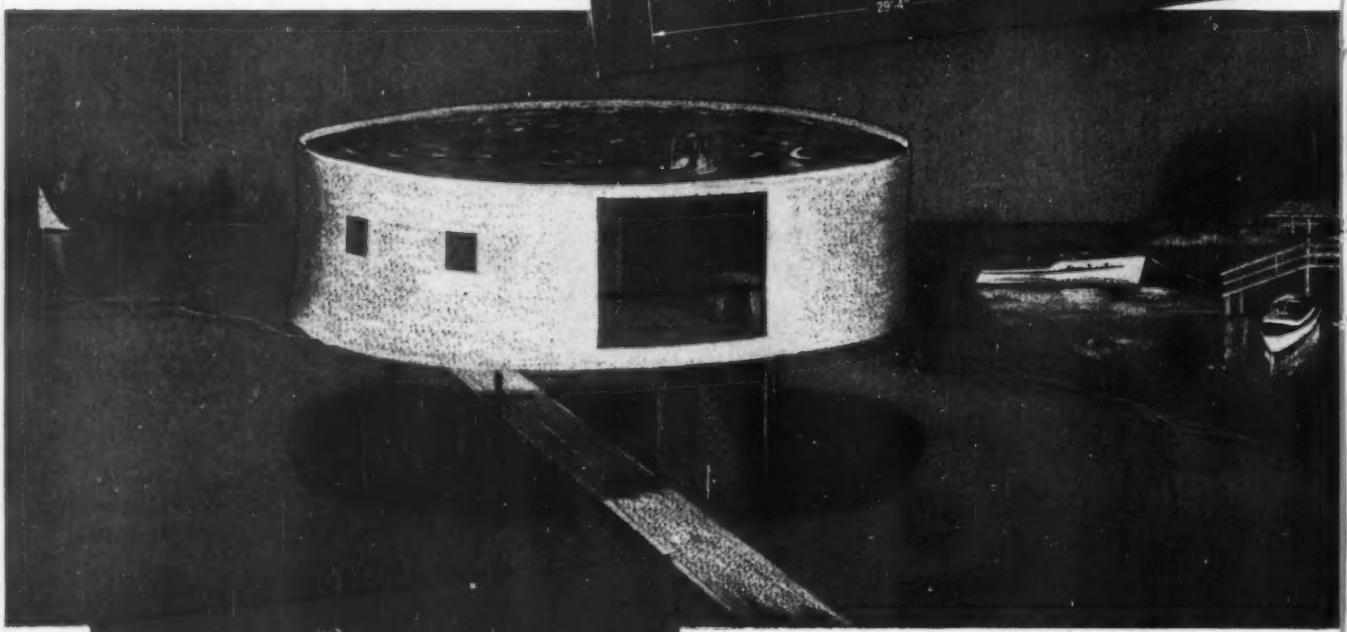
The liquid formulation of a sprayed-on plastic can be based on any one of a number of thermoplastic resins. Vinyl has captured the lion's share of this market at the present time, but other plastics materials, including acetate, acrylic, and butyrate, are moving into prominent positions.

Already in production by one company, for example, is a unique type of seamless lamp shade—described further on in this article—which is made by spraying a cellulose acetate formulation onto an aluminum form.

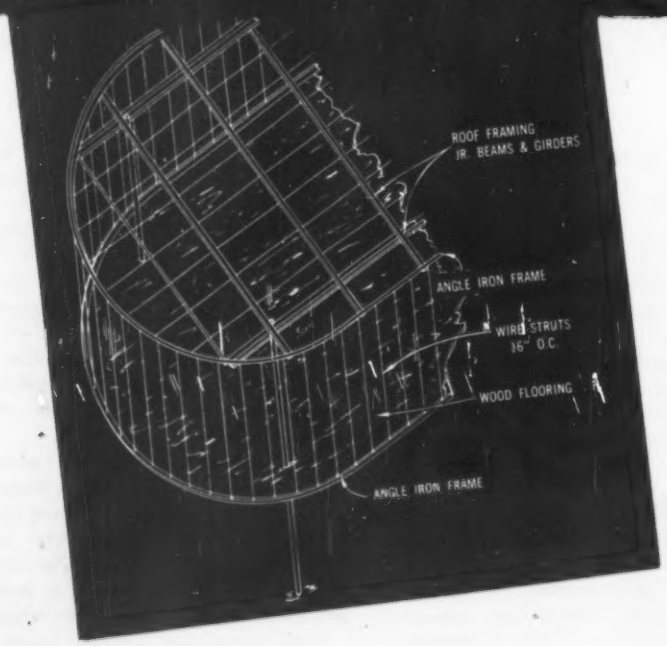
Another company, Eastern Industrial Service, Inc., Cambridge, Mass., is marketing a liquid emulsion, based on acrylic resins, to be sprayed on glass windows. The liquid quickly dries to form a nonstrippable, translucent film which

Raised sprayed-on vinyl beach house (below), cooled by a pool of water pumped into a depression in the roof, is one designer's conception of a future application that may evolve from the successful use of sprayed-on materials in the construction field. Walls and roof of the house will be built by spraying vinyl sheeting over a grid of light steel girders and tension wires (diagram, bottom left). Access to the living quarters (floor plan, right) will be through a spiral stairway





Original designs by Guy G. Rothenstein



adheres to the glass. By filtering out up to 95% of the ultra-violet rays and by reducing the transmission of infra-red rays, the film makes for cooler, more satisfactory working conditions in factories, schools, or homes.

The possibilities of a sprayed-on cellulose acetate butyrate to be used as a strippable protective coat for equipment in storage or in transit are being investigated by Eastman Chemical Products, Inc. The weather-resistant strippable butyrate coverings currently available are applied by a dip coating process. From the standpoint of utilizing the spraying technique, the big problem in this case has been the formulation of an emulsion containing a high enough percentage of solids to make spraying a practical process.

As a solution to the problem, the laboratories of Eastman Chemical have recently announced a new "half-second butyrate" which contains up to 20% solids; currently being worked on is a flame spraying process similar to that which has proved so successful in the application of polyethylene coatings.

Sprayed-On Vinyls

However, the sprayed-on vinyls are presently in the most advanced stage of development in the field. As the recognized pioneer among sprayed-on plastics, vinyl is in the limelight. The techniques that have been—and will be—learned in applying and using the material will prove of value in the development of other sprayed-on plastics.

The advances that vinyls have made in the 10 years since "Operation Mothball" have been dramatic and important ones. Originally considered strictly as maintenance products, sprayed-on vinyls stand today on the threshold of exciting new careers in a diversified list of industries.

One recent development that has stirred up a lot of excitement is an attractive arm chair manufactured almost entirely of sprayed-on vinyls. Recently introduced by Progressive Industries, Inc., Long Island City, N.Y., the chair represents an important step forward—not only because it may start a new trend in the construction of modern upholstered furniture but because it has successfully bridged the gap between the use of sprayed-on plastics for simply coating or covering an object and the structural use of these materials to actually manufacturing an end product.

Before describing the arm chair in more detail, it would be well to review a little background. What will follow the development of the arm chair raises many intriguing questions. What preceded its development may hold the clue to the answers.

Peelable Plastics

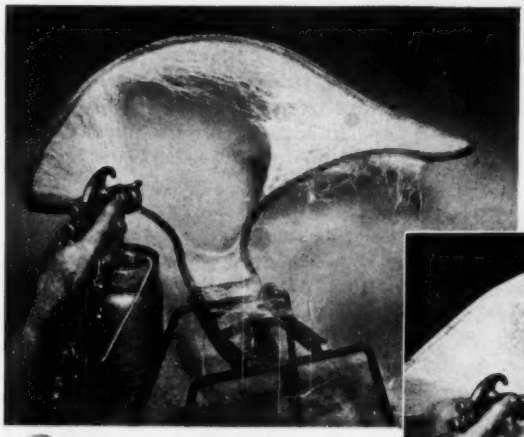
Basically, the liquid vinyl which is sprayed-on to form the film covering consists of an emulsion of vinyl resins—supplied largely by Bakelite Co. and The B. F. Goodrich Co.—combined with various volatile solvents. When sprayed onto a surface with an ordinary paint spray gun, the solvents evaporate, leaving the solids in the form of a tough, durable covering.

This covering is unique in two respects. First—unless it is formulated to adhere permanently—it is completely strippable. That is, although it adheres firmly to the surface on which it is sprayed, it can, when desired, be stripped off cleanly with little effort and with no damage to the underlying surface.

Secondly, the covering can be sprayed on as a continuous film or sheeting or as a webbing across open spaces. When mixed with special webbing solutions, the distance that the webbing filaments can span is as much as 24 in. across.

As far as the other properties of sprayed-on vinyl coverings are concerned, no definite figures can be given. By changing either the formulation or the method of spraying, each of the physical properties, including the degree of adhesion, can be emphasized or toned down. Tensile strengths, for example, can range from 1200 to 2000 p.s.i. and elongation from 200 to 300 percent.

To provide a general indication of characteristics, however, the physical properties of a sprayed-on vinyl sheeting, 0.035 in. thick, are listed as follows: weight, 2 oz. per sq. ft.; tensile strength, 1200 to 1400 p.s.i; elongation, 200 to 225%; abrasion, loss of 75 mg. after 5000 revolutions of Taber abraser; wear, loss



Initial step in manufacture of back and arms of sprayed-on arm chair is creation of vinyl web across open metal frame

When web is filled in sufficiently, vinyl sheeting is sprayed over it

Completed sprayed-on wing arm chair is a comfortable modernistic unit

Sheeting is also sprayed on seat to duplicate texture of back section

of 0.001 in. after 1000 revolutions of Taber abraser; temperature range, —40 to 180° F.; vapor transmission rate, not more than 0.5 g. per 100 sq. in. per 24 hours.

Sprayed-on vinyl coverings are, in addition, resistant to bacteria, fungi, alkalis, oils, alcohols, salt spray, and many industrial acids. They do not support combustion, are non-corrosive, and can be pigmented with practically any color, including aluminum or other metallic dispersions to reflect the rays of the sun.

In addition to R. M. Hollingshead Corp., Camden, N.J., and Better Finishes and Coatings, Inc., Newark, N.J.; who pioneered sprayed-on vinyls for Government packaging, the companies who have shared in their development include: Plastic Coating Corp., Houston, Texas; Progressive Industries, Inc., Long Island City, N.Y.; Protective Coatings, Inc., Tampa, Fla., distributors for Hollingshead; The Striplastic Co., Cleveland, Ohio; and Surface Engineering Co., Inc., Wichita, Kan.

Protective "Packages"

When the sprayed-on vinyls became commercially available in the early part of 1950, their first industrial application was as protective "packaging" (similar to "mothballing") for goods and machinery in storage or in transit.

In addition to their obvious benefits to industry—their ease of application, the savings in weight and space, protection against the elements, and the ease with which the film could be peeled off—the vinyl film "packages" had another and more important result. The spraying techniques that were learned by industry for applying the vinyl "skin" to machinery and equipment led directly to the development of the spray-on vinyl arm chair—and opened innumerable possibilities for the future. A comparison of the method used to "mothball" a product and that used to produce the chair will illustrate the similarities.

To encase a piece of industrial equipment in a protective vinyl "skin," R. M. Hollingshead Corp. recommends the following procedure.

The unit is first thoroughly cleaned and placed on a base. All sharp, protruding points which might tend to rupture the vinyl covering are padded with clean, dry rags and all large openings more than 20 in. wide are cross taped with pressure-sensitive tape ½ to 1 in. in width.

Courtesy Better Finishes and Coatings, Inc.
Application of sprayed-on vinyl sheeting to a roof surface requires a minimum of labor. Sheeting forms a protective seal against water, weather, and mildew

The liquid vinyl, mixed with a special webbing agent, is then sprayed onto the taped machine from a distance of approximately 2 feet. As the long fibers of the web "float" out to bridge the openings, the gun is moved closer until a continuous webbing has been formed.

The regular film-forming formulation of liquid vinyl is then sprayed over the web. A differently pigmented vinyl is usually used for each separate pass of the spray gun so as to ensure uniform application. In performing this operation, careful attention must be paid to the pressures being used in order to prevent the spray from breaking the webbing. Fluid line pressure when laying on the vinyl film covering should be from 20 to 30 p.s.i. and atomizing pressure at the gun tip approximately 70 p.s.i.; for application of the webbing, fluid line pressure should be about 10 to 15 p.s.i. and atomizing pressure approximately 30 p.s.i.

When the desired thickness—determined by the length of time the unit will be stored—has been reached, the spraying is discontinued and ventilating holes are cut to allow escape of solvent vapors. These openings can later be patched with a section of vinyl film that had been sprayed on a sheet of metal at the beginning of the operation and then stripped off.

As the final step in preparing the package, a square hole is cut in the center of the vinyl covering. A special humidity indicator card is placed inside the hole and a square

Courtesy Better Finishes and Coatings, Inc.
To weather-protect an outdoor metal statue, a coating of clear vinyl is sprayed on exposed areas

Courtesy Bakelite Co.

Vinyl sheeting can be stripped off "packaged" winch in 30 minutes

Courtesy Bakelite Co.

Vinyl coating, sprayed on exterior side walls, caulks all cracks and openings. Coating will expand or contract with any movement of the building

of acrylic sheet taped over it. The card is thus always visible as a continual check on the presence of moisture.

Sprayed-On Arm Chair

So much for the background. On this basis, designer Guy G. Rothenstein and Progressive Industries, Inc., collaborated to produce the sprayed-on vinyl arm chair.

The chair is easily adaptable to economical mass-production methods. The back and arms of the chair consist of vinyl webbing and sheeting sprayed on an open metal frame. After a sufficient surface of webbing has been produced, the spray is changed to build up a strong sheeting of the desired thickness. The shape is formed as a result of the tension of the plastic. After curing, the back and arms become a flexible but solid unit, odorless and non-toxic.

The seat of the chair is formed by a section of sheet metal with a pre-shaped pad of foam vinyl, over which a vinyl sheeting that exactly duplicates the attractive leather-like finish of the one-piece back is sprayed.

The completed arm chair, which is available either as a four-legged chair or as a reclining swivel unit, is a tough, durable piece of furniture with no seams, creases, or visible fastenings to break the sweep of its curves. It can be used indoors as well as outdoors; it is unaffected by weather; it is completely impervious to moisture, mildew, scuffing, or stains; and it can be washed in soap and water. To "reupholster" the chair in a new color scheme, all that is necessary for a quick and inexpensive job is a spray gun and a can of pigmented liquid vinyl.

Lampshades, Roofs, and Walls

The sprayed-on lampshades already mentioned are being produced by Brewster Handcraft Industries, Old Lyme, Conn., on an economical mass-production basis.

A cellulose acetate spraying formulation—the base material is supplied by Hercules Powder Co.—is sprayed onto revolving aluminum forms shaped to the contours of the desired shades. As soon as a sufficiently thick coating has been built up, the units are removed from the spray booth and partially cured. They are then placed in another booth where various colors are sprayed on. After the spraying operation is completed—approximately 30 passes with the spray gun are required—the shade is cured on a rack and then slipped off the form.

The finished lampshade has a smart opaque look during the daytime; it produces a well-diffused glow when lit at night. Because of the unique method of manufacture, the shade is seamless and flexible.

Similar lampshades, made from spray-on vinyls are also in commercial production by other companies.

The techniques used in "Operation Mothball," have given birth to chairs and lampshades; they have also attracted a great deal of attention in the building trades by their use in sprayed-on resurfacing of roofs and walls with vinyl. (See also "Vinyl for Outdoor Protection," MODERN PLASTICS *29*, 95, July 1952.)

A properly compounded liquid vinyl, when sprayed on a wall or roof, no matter how old or how new, produces an impervious, attractive protective coating which is resistant to moisture, mildew, grease, and scuffing; non-combustible; moistureproof; and washable. It will caulk all cracks and openings and seal windows, skylights, and parapets.

With such an over-all vinyl coating, which can be laid on any surface with a minimum of labor, those age-old enemies of any structure—expansion, contraction, drying out, and cracked and open joints—can be economically combatted.

Despite continual exposure to the elements, sprayed-on vinyl coverings will still be in good condition after 8 to 10 years. When necessary, an additional 10- to 15-mil sprayed-on film will reactivate the original vinyl sheeting. Here vinyl as a surface coating demonstrates its su-

Courtesy Hercules Powder Co.

Attractive, translucent lampshade, flexible and completely seamless, is made by spraying a cellulose acetate formulation onto an aluminum form

periority over paint: the strength of vinyl sprayed-on sheeting increases as its thickness is built up.

And Now a House

According to designer Rothenstein, the success of sprayed-on vinyls for resurfacing roofs and walls will have extensive repercussions on the selection of the materials going into structures as well as on methods of erection.

With sprayed-on vinyls, materials classified "for interior use only" can be used for exterior construction as well; heavy and expensive brick, stone, or metal facings can be replaced by vinyl sheeting sprayed on columns, spandrels, and back-up masonry; canopies, balconies, and other projections of the building can be covered with the same "continuous skin" that is sprayed over the vertical surfaces of the building; and roofs may be built in the same manner as walls with no waterproofing problems posed by such projections as upset beams or skylights. In maintaining a building having an exterior facing of vinyl sheeting, re-caulking or steam-cleaning the entire facade is unnecessary. A clean, new surface can be quickly and economically applied.

Out of all this, Mr. Rothenstein visualizes a complete summer beach house built around the spraying technique. Sketches of such a house are reproduced on p. 94. The framework of the house is a grid of light steel girders and tension wires, over which vinyl webbing and filler will be sprayed. The roof will be constructed in the same way but will be designed with a slight depression in its center. A pool of water in this depression, controlled by a pump from within the house, will cool the house.

The colorful, lightweight house—a triumph in ease of construction and installation—will be erected on stilts to minimize the possibilities of vandalism. As a further safeguard, the walls could be sprayed over wire mesh.

Courtesy E. M. Hollingshead Corp.

Aircraft engines are prepared for overseas shipment by being sealed in protective "packages" of sprayed-on vinyl sheeting

"Wallpaper" and "Linoleum"

Sprayed-on vinyl as a wall finish has already been successfully used in many buildings, particularly in public institutions, often in lieu of calendered sheeting. Sprayed on an inside wall, the spray forms a continuous, jointless sheeting of attractive appearance with much better wearing qualities than paint or wallpaper. The finish can be washed, or even harshly scrubbed, as often as desired.

As more and more building owners become aware of the savings that sprayed-on plastic finishes can effect over a period of years, the industry can expect to see a corresponding increase in their use.

A similar future is predicted for sprayed-on coverings for floor surfaces. Such sprays, when applied over heavy felt or foam rubber pads, form resilient and sanitary wall-to-wall carpetings. They are attractive, easy to apply, and are reported to have excellent wearing qualities.

Industrial Protection

Strippable vinyl films applied to metal surfaces as protection against scratches during fabrication or as a masking material during finishing operations have proved their merit. When sprayed onto metal, the liquid dries into a tough, strippable film, that protects the metal surface during drawing, routing, drilling, or shearing. Since the flexible film can be stretched to well over 200% of its original length, it will remain firmly adhered to the metal even while the part is being bent or formed. After the processing operations, the film can be stripped off.

Miscellaneous Applications

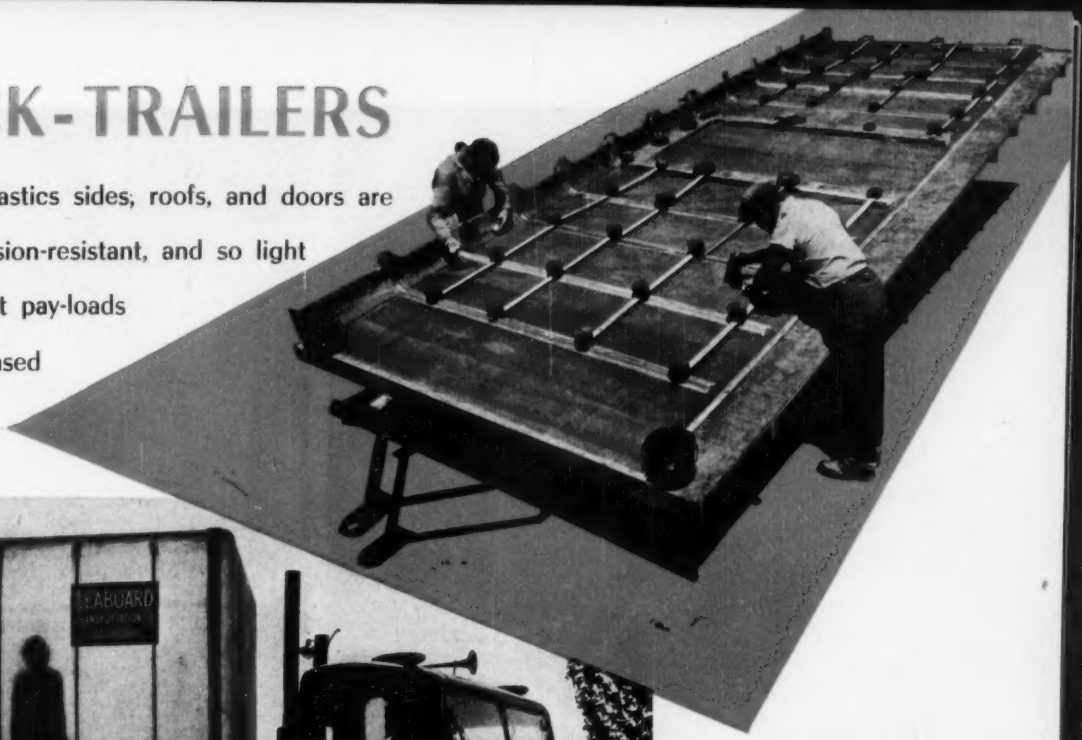
In such specialized industries as coal mining, sprayed-on coatings seal temporary or permanent shaft stoppings against moisture, gases and loss of fresh air into the blocked shaft.

As a sealant, the sprayed-on films have also proved effective for closing up tobacco warehouses during fumigation, for lining the inside of tanks as protection against corrosion, and for dust-proofing cinder

(*Continued on page* 207)

TRUCK-TRAILERS

Reinforced plastics sides, roofs, and doors are strong, corrosion-resistant, and so light in weight that pay-loads can be increased



Side of 24-ft. Seaboard Transportation trailer body being molded of reinforced plastics. When cured, support ribs become integral with section

Front end of completed trailer body. Silhouette of girl standing inside illustrates transparency of the reinforced plastics construction

THE rapidly expanding use of reinforced plastics as a structural material for automobile bodies is extending also into the production of large truck-trailers. In the East, Strick Co., Philadelphia, Pa., and on the West Coast, Seaboard Transportation Co., Antioch, Calif., are using these materials because they are strong, light in weight, dentproof, corrosion-resistant, and translucent when unpigmented. Both companies are using plastics structural components molded of Vibrin polyester resin, supplied by Naugatuck Chemical, Div. of U.S. Rubber Co., with fibrous glass reinforcement.

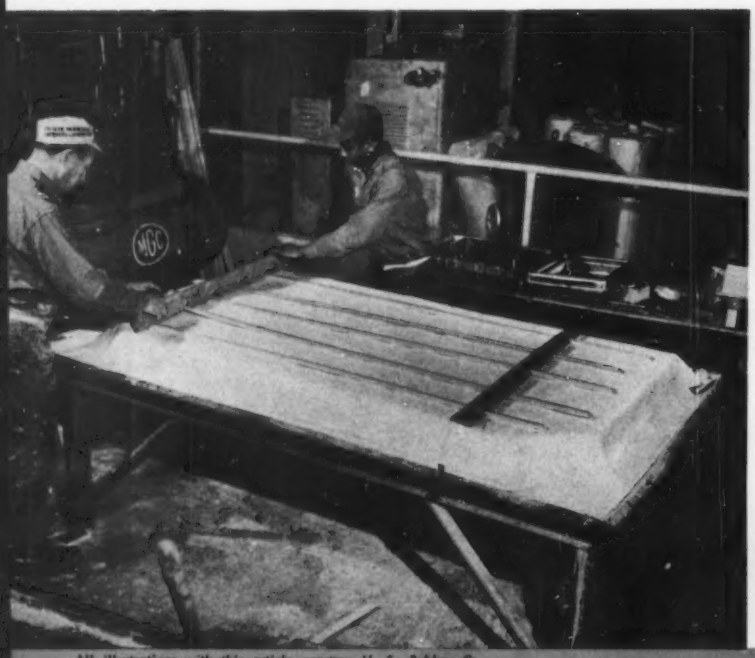
To date, the largest plastics trailer bodies built by Seaboard are 24 ft. long by 8 ft. wide and 8 ft. high. This is the size most commonly used by the company, which operates heavy duty trucking units capable of carrying any type of load in California, Oregon, and Washington. These units are used in "trains," consisting of a tractor and two semi-trailer combinations, with a gross over-all weight of 76,800 lb., the maximum permissible in coast states. The equipment is subjected to extremely heavy usage in all types of weather conditions and temperatures, from the desert areas in California to the snow and ice covered mountains of the northwest.

Preformed Ribs

Construction of the plastics trailer bodies is not complicated. Fibrous glass cloth and mat, cut to specifications, is layed up in molds and saturated with the polyester resin. Preformed ribs, made of the same material, are pressed into the wet lay-up to form a complete section, the parts of which, when cured, become one integral unit.

The bodies are made in four sections: two sides, the roof and front section. The space at the rear is used for doors. After each section is completely cured, they are assembled and bonded together by resin and mechanical means, on conventional trailer chassis.

Seaboard Transportation Co. officials have developed such enthusiasm about the future of this material in the field of transportation that they have organized Seaboard Plastic Development Co. to manufacture for the general public. They are confident that the use is not restricted to the field of heavy freight hauling



All illustrations with this article courtesy U. S. Rubber Co.

Reinforced plastics door liners for Strick "reefer" trailers have molded-in ribs; vertical ribs are positioned on glass mat laid-up over horizontal ribs

With vertical door liner ribs held in place, additional layers of glass mat are unrolled over them

only, but that it has great possibilities, particularly for haulers of dairy and creamery products, fish, or any other product requiring refrigeration.

Economic Possibilities

Semond Levitt, head of Allied Plastics Corp., a Strick affiliate, also sees reinforced plastics as having many economic applications in the cargo hauling industry and calls its use "the first important forward step since frameless aluminum trailers were introduced by Strick over a decade ago."

Three out of four of the trailers rolling off the Strick production line, which turns out a completed unit every 30 min., have "sky-light" roofs made from panels of reinforced plastics. Others have reinforced plastics sides, interior liners, and doors.

The "sky-light" roof trailers have one or two reinforced plastics panels, 8 by 4 ft., built into the roofs. The resin used in these panels is unpigmented, so that enough light enters the trailer to permit reading shipping labels. The "sky-lights" thus speed up loading and unloading operations.

Since it is corrosion resistant, as well as strong and light in weight, the reinforced plastics is also used for complete sides and roofs of a number of van-type trailers. These are used to haul corrosive materials, such as commercial chemicals. Service reports indicate that the trailers will have considerably longer life than those previously used for corrosive materials.

In most Strick refrigerated trailers, reinforced plastics interior liners are used because they stand up under the abuse of loading and unloading, will not rot or become contaminated, and will not swell under steam cleaning—a regular procedure with refrigerated trailers.

Molded Doors

Nearly all the company's insulated trailers are equipped with molded plastics doors and door frames. The door sections, which are up to 200 lb. lighter than wooden ones, are molded in one piece and are filled with an insulating material. They are strong, rustproof, warp-proof, and are reported to maintain their tight fit for the duration of the service life of the trailer.

In the assembly of the trailers, the side panels are riveted to exterior aluminum posts and, together with a top and bottom aluminum rail, form the load-carrying members of the trailer. Riveted construction is also used for roof panels in completely plastics roofs and in the "sky-light" roofs.

Five different plastics parts are used by Strick in its trailers. The translucent roof panels are molded of glass mat and unpigmented resin and measure 50 by 92 in. by 0.055 in. thick. The other four elements are molded of a combination of fibrous glass mat, cloth, and resin. These include outside panels, inner liners, doors, and door jambs or frames. The outside panels measure 49 by 89 in. and are $\frac{3}{32}$ in. thick except for a 3-ft. wide band at the bottom which is built up to $\frac{1}{8}$ in. for added strength.

The inner liners, with integrally molded spacers or ribs, measure 49 by 74 in. and are 0.080 in. thick. The doors for the refrigerated type trucks measure 45 by 80 in. and consist of a one piece molded shell or pan approximately 6 in. deep. The wall section of the shell is approximately $\frac{1}{8}$ in. except where wooden reinforcing ribs are molded in. Door

With lay-up in mold, resin is poured into trough; impregnation of fibrous glass takes place under vacuum

After vacuum impregnation is accomplished and cure is complete (see description in text on page 102), the door panel or shell is removed from the mold

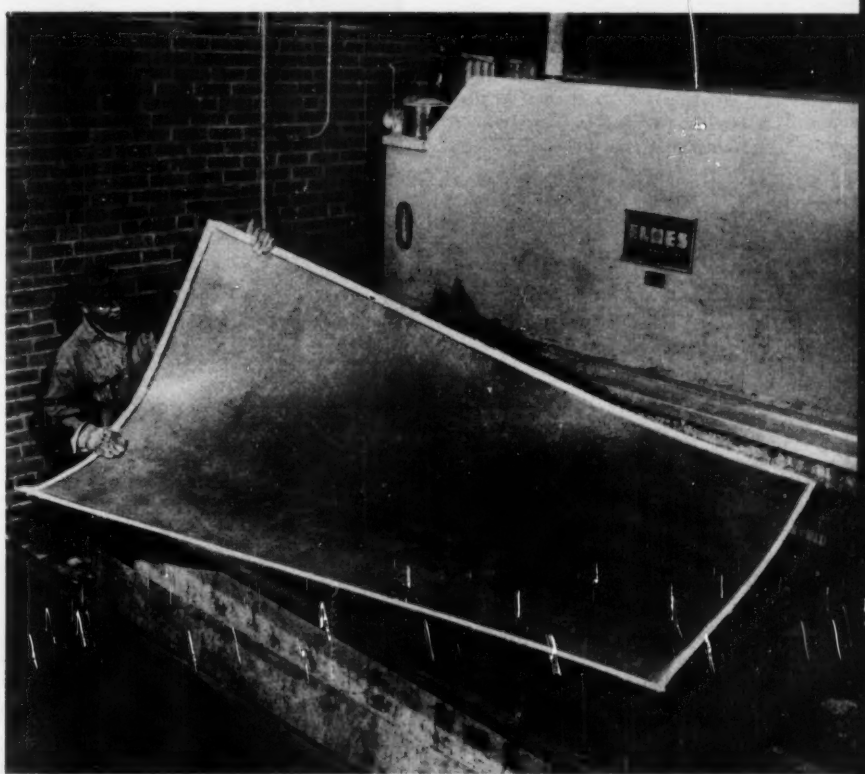
jambs or frames are approximately 8 ft. long with a wall section of ⅛ inch.

In the case of the roof and outside panels, the sheets are molded between highly polished caul plates. The inner liners and door jambs are molded in matched metal molds. The doors are produced in metal molds with the resin being sucked into the molds by vacuum.

Production Method

The manufacturing procedure used for producing the doors required a great deal of ingenuity and research on the part of Strick engineers before a satisfactory procedure was evolved. In the method now employed, comparatively wide horizontal plywood strips and comparatively narrow vertical plywood strips are used as reinforcing material. Strick refers to its method of reinforcing as "enclosed reinforcing." When the door is completed, all of the plywood strips are completely covered with resin and glass.

The first step in laying-up one of these doors consists of placing patterned sheets of mat on the male mold. Horizontal slots in the male mold are sufficiently wide so that



Completed reinforced plastics panel is removed after being formed on press in rear. Lightweight and flexible, it will be used as a side panel in a trailer body

All illustrations with this article courtesy U. S. Rubber Co.

Reinforced plastics door liners for Strick "roofor" trailers have molded-in ribs; vertical ribs are positioned on glass mat laid-up over horizontal ribs

With vertical door liner ribs held in place, additional layers of glass mat are overlaid over them

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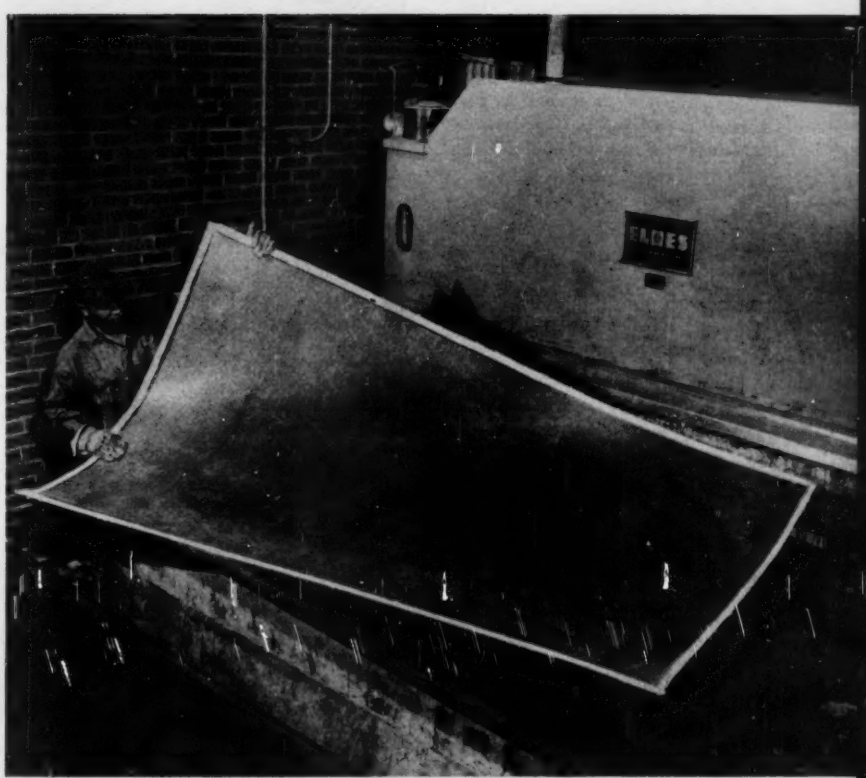


Completed reinforced plastics panel is removed after being formed on press in rear. Lightweight and flexible, it will be used as a side panel in a trailer body

when one of the horizontal plywood reinforcing strips is pressed downward on the mat over the slot, the strip is forced into the slot, carrying the layer of glass mat with it. After the horizontal strips have been forced into the slots until they are flush with the surface of the male mold, sections of fibrous glass cloth tailored to fit the entire top surface of the male mold are laid into position.

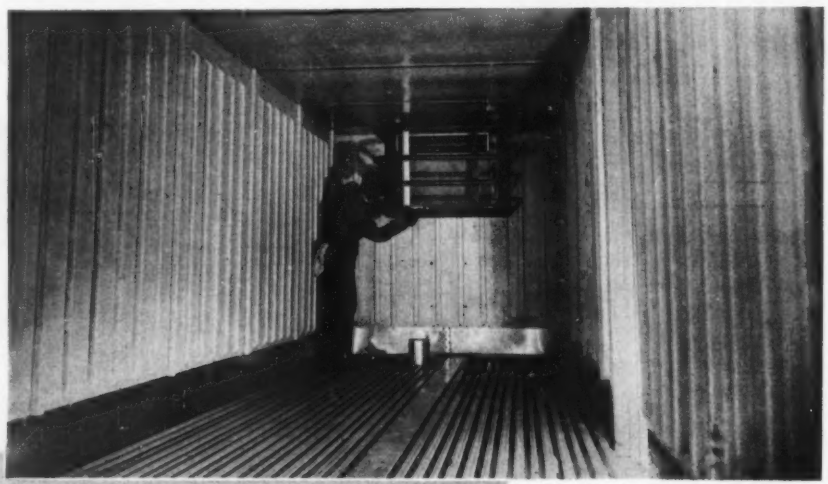
Next, the vertical reinforcing strips are placed in position on the glass cloth. The spacing of these strips is controlled by two jigs. Additional layers of fibrous glass mat are then laid up on top of the vertical reinforcing strips and the female or top half of the mold is placed in position. In vacuum impregnation by the Marco method, it is necessary that the parting line between the two mold halves be open so that, when a vacuum is pulled in the mold, resin will be forced by atmospheric pressure to run into the mold.

After the lay-up of the glass cloth and mat is completed, it is placed in the molding fixture and the two mold halves clamped tightly in position. The molding fixture in this case consists of a base to hold the molds and a trough running around all four sides of the mold. Polyethylene tubing is used to connect vacuum ports in the top half of the mold through a sight glass to a source of vacuum. Next a measured amount of resin is poured into the trough and the vacuum applied. This forces the resin through the opening between the two mold halves so that it thoroughly impregnates all the fibrous glass cloth and mat, and coats the wooden reinforcing strips. Complete impregnation is indicated when a solid column of resin is forced into the sight glass; the vacuum port openings are then clamped tight and curing proceeds.

When curing is complete, the mold is opened and the finished shell removed. Excess flash is trimmed and the parting line sanded smooth. Bats of fibrous glass insulating material are then laid in the shell and the open side of the shell is covered with an aluminum sheet which is bolted fast around the periphery of the shell.

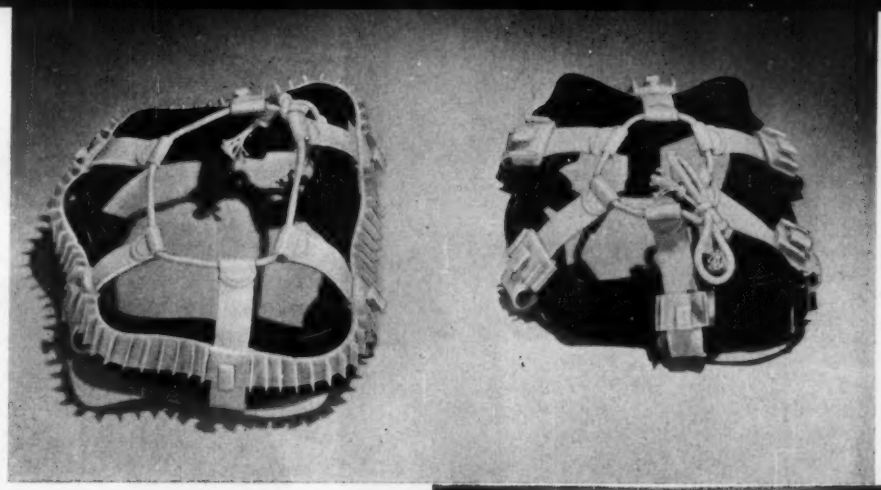
Plastics frames add to the efficiency of the door in that they will not warp, absorb moisture, transfer odors, or permit temperature leaks from the trailer.

The design of this refrigerated unit, known in trucking parlance as a "reefer," revolutionizes this type of trailer. The doors, frames, and interior liners give a weight advantage up to 1000 lb. per unit. According to Strick, their four years of research work on this project have proved conclusively the unqualified success of reinforced plastics in truck-trailers.



Interior of refrigerator trailer-truck with walls and roof lined with reinforced plastics. The material will not deteriorate when interior is steam-cleaned—a regular procedure with refrigerator type trailers

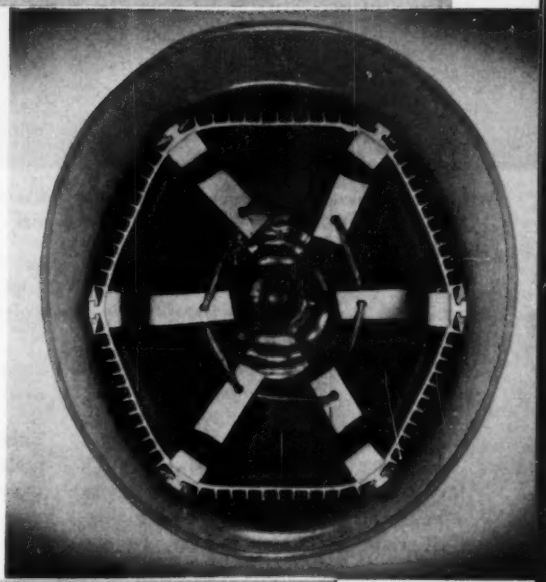
Trailer, 32-ft. long, has reinforced plastics sides and roof. Use of reinforced plastics in its construction makes it particularly useful in the haulage of corrosive chemicals



Vinyl headband comes in two forms: buffer type (left) adds side impact protection; regular type (right) weighs 1 oz. less

Six projections molded-into vinyl headband fit six slots molded-into inside of rim of shell to secure band in place

Safety With Comfort



Chemically resistant shell of safety hat is injection molded in one piece of modified styrene copolymer, thus has no joints or seams

THE attitude of the American workman toward the use of personal safety equipment raises many problems for both designer and manufacturer. Despite the fact that the primary function of all safety appliances in general and hats in particular is to protect the user from occupational hazards, workers will not willingly wear them unless they have been designed for the utmost in comfort and practicality.

One manufacturer, Willson Products, Inc., Reading, Pa., turned to plastics for help in designing one piece of safety equipment. The result is a new all-plastics protective hat which is as tough as conventional metal safety headgear, yet is more comfortable to wear.

The one-piece shell of the hat is injection molded in a single-cavity mold on a 16-oz. H.P.M. machine; the material is Kralastic modified styrene copolymer, supplied by Naugatuck Chemical, Div. of U. S. Rubber Co. The suspension hammock-type headband, which fits into the inside rim of the shell, is molded in a single-cavity mold on a 6-oz. Reed-Prentice, using a vinyl compound supplied by Bakelite Co.

The tough yet resilient shell of the helmet is designed with curves which deflect falling or flying objects. For added strength, six vertical reinforcing ribs are molded directly into the shell.

When the hat is worn, it rests

(*Continued on p. 212*)

Portable is

Portable record player, housed in a colorful, streamlined injection molded styrene case, weighs only 6 pounds

Although conveniently small in size, the record player, with the hinged top swung back, plays large records

HERALDED as the "newest sensation in the phonograph line," a portable electric record player housed in an all-styrene case makes dramatic and functional use of plastics materials.

In addition to the case, the plastics components of the new phonograph include a molded styrene motor board, which supports chassis and turntable, and a molded styrene carrying handle. The compact, streamlined phonograph—smaller, lighter, and more dynamic in design than the box-shaped wooden models currently on the market—is being produced by Sonic Industries, Inc., Long Island City, N.Y.

Outstanding Advantages

When considering the design of the new phonograph, Sonic Industries was determined to create a product that would be truly distinctive in style, yet one which would meet the company's high standards of quality. Plastics made possible the fulfillment of both requirements.

From the standpoint of performance, the new phonograph is not only comparable to the wooden model, but, in many respects, is far superior. Outwardly, the unit looks like a streamlined portable radio. Enhancing its modern design is the wide variety of lively colors in which the case is available. The case may be either a single color—green, white, tan, maroon, or grey—or two-tone. For the latter, the top and bottom halves of the case are one color while the motor board, the edge of which serves as a separating band between the halves, is in a contrasting color.

Since color is integral to the parts, scratches caused by handling are hardly noticeable. The smooth, glossy surface of the case, which requires no further finishing once it has been molded, can be easily kept clean with a damp rag. Unlike the painted or leather-covered wooden models, there is no danger of the finish peeling, splitting, or tearing off.

In size, the portable phonograph is no bigger than standard (AC-DC-battery) portable radios. It measures 9⅛ in. high, 11¾ in. long, and 4¾ in. deep and weighs only 6 pounds. A comparable wooden model, in the same price category, would measure at least 1 in. more in all three dimensions and would weigh 9 lb.—50% heavier than the plastic model.

As important an advantage as the external appearance and the light weight of the plastic model is the fact that the styrene case offers added protection against damage to the operating mechanism of the phonograph. If the unit should be accidentally dropped, the tough, resilient styrene case absorbs most of the shock of impact, reducing the probable damage to the motor or other internal parts.

Operation

In designing the Duosonic phonograph, the company added several features that contribute to the ease and convenience of using the unit. One of these is the flat styrene "tuck-a-way" handle which doubles as an automatic snap-lock mechanism that holds the lid and base of the case securely together while the phonograph is being carried.

The operation of this locking mechanism is simple, but effective. When the lid of the case is closed, two projecting lugs molded-into the front edge of the lid fall into two recessed cavities molded-into the front of the motor board. Lifting the phonograph up by the handle causes two metal fasteners attached to each end of the handle to be automatically pulled forward until they

Beautiful in Plastics

slide into place over these lugs. Since the handle, when held in this upright position, prevents the metal fasteners from sliding, it is impossible, as long as the phonograph is being carried, for the lugs to slip out from behind the fasteners or for the case to open accidentally.

When the phonograph is ready to be used, the metal fasteners are slid back until the flat handle is flush with the surface of the case—and completely out of the way of the user of the machine. The lugs are now free to pull out of the cavities as the lid is opened. The lid swings back until its extended rear edge engages the motor board. In this position, the lid will not fall forward if the phonograph is jostled while being used.

Despite its small size and compact construction, the phonograph incorporates most of the standard features of today's larger models. It is a three-speed phonograph that can accommodate 7-, 10-, or 12-in. records. The turntable can be used for 78- and 33-r.p.m. records without any additional attachments. For the 45-r.p.m. records, which have a wider spindle hole, however, a special plastic disk supplied with the phonograph must be slipped over the spindle.

The phonograph also has a lightweight, retractable pick-up arm, with a dual turn-over needle for the different types of records. The end of this arm is attached to the motor board by a metal spring. When the lid of the phonograph is closed, it pushes the arm down, against the pressure of the spring, until it is almost flush with the surface of the motor board. The manufacturer thus saves at least 1 in. of space—the extra amount that would be necessary in the depth of the unit to accommodate a regulation arm.

Molding

The four plastics parts—lid, base, motor board, and handle—are injection molded in a 5-cavity mold by Majestic Molded Products, Inc., New York, N.Y. Since the speed and accuracy of assembly of the parts of the phonograph depend on the proper alinement of molded-in holes, ribs, and lugs, parts with close tolerances were essential. This, of course, called for careful attention to detail in machining the mold. Because of the large area of the mold, a 200-oz. Watson-Stillman machine is used. For each shot, which produces the four parts plus one extra handle, approximately 31½ oz. of medium-impact styrene, supplied by Catalin Corp. of America and Monsanto Chemical Co., are used.

As the mold opens at the end of the cycle, each of the five parts are automatically degated, so that they may be removed as individual pieces, ready for the assembly line. To eliminate any unsightly marks on large surface areas, knockout pins are used only on the thin edges of each part, where knockout marks would hardly be noticeable.

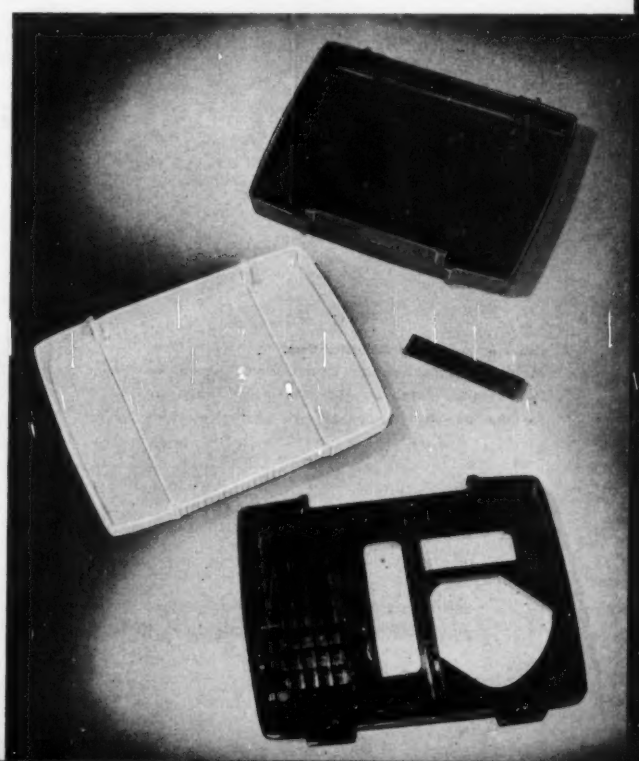
The trade name of the product and the company name are hot-stamped on the lid of the case and a raised dial face indicating the three different speed positions and the "off" position is hot-stamped into one corner of the phonograph's motor board.

Of the four plastics parts, the motor board represents the most complicated molding job.

Since it is this piece to which the handle as well as the lid and base are fastened, it has to have all the holes, ribs, lugs, etc., necessary for exact positioning. These are all molded-in rather than provided by subsequent machining or fabricating operations. For attaching the base, for example, two holes are molded-into the two sides along the length of the board. These holes correspond in position to four cored bosses along the edges of the base and are used during the assembly operation to accommodate the four screws that hold the lid and the board together.

The underside of the board has a series of raised ribs and openings, which serve as guides when installing the motor. On the top surface of the board are a raised circular rib on which the turntable rests and a rectangular projection to the right of this rib which supports the phonograph arm when it is not being used. In the upper left-hand corner of the board are two molded-in vertical slots designed to accommodate the prongs of the electrical connect-

(*Continued on p.* 211)



Molded styrene parts of new phonograph are (from top to bottom) lid, handle, base, and motor board. Note speaker grille molded into the motor board

Adding Machine in Styrene Housing

YESTERYEAR'S cumbersome business machines and today's streamlined equipment present a dramatic comparison. The changes have been numerous—and the beauty, light weight, and durability of plastics have played an important part in bringing many of them about.

Office equipment using plastics in its construction can be styled to harmonize with modern decor and still be sturdily built for heavy-duty operation. The Clary Multiplier Corp., San Gabriel, Calif., for example, recently introduced a new hand-operated adding machine with a molded styrene housing. In contrast to die cast metal, which has long been accepted as standard in the field, the molded plastic housing is lighter, more decorative, less expensive and offers better protection against damage to internal mechanical parts.

The complete styrene-housed machine weighs only 19.5 lb., as against 30 to 33 lb. for competing models. Coupled with small size—the adding machine is only 14 in. long, 7 in. high, and 9 in. wide—this light weight makes it suitable for portable use and for easy handling by women employees.

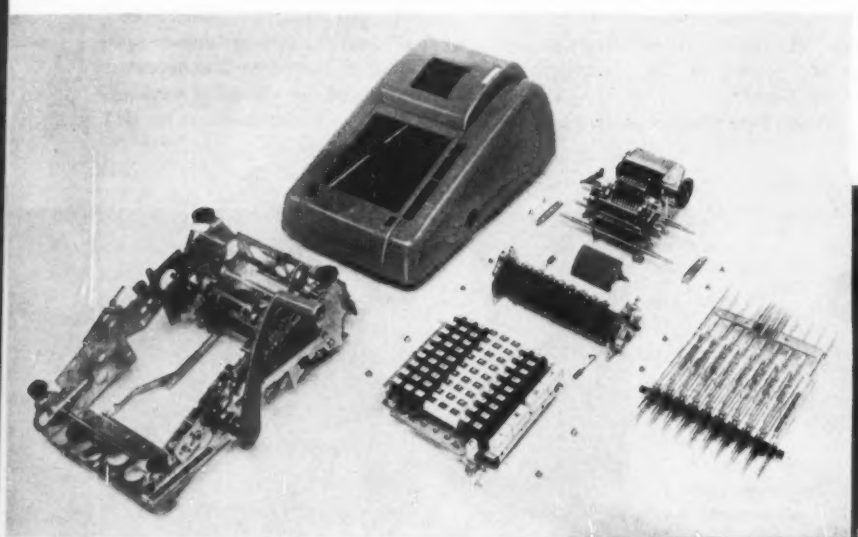
The resilient styrene housing has shock-absorbing qualities which serve to protect internal parts from damage in case the machine is accidentally dropped. The housing, which can hold a 250-lb. weight without bending or breaking, is also durable enough to withstand rugged service abuse.

The housing is molded by The Plas-Tex Corp., Los Angeles, Calif., using Dow's No. 475 high-impact styrene. The entire unit is produced in one piece, including a series of bosses molded-into the shell to facilitate assembly. It is run on a 22-oz. Reed-Prentice in a single cavity mold with no sidecuts or movable parts. The molding cycle averages about 60 shots per hour.

Unlike traditional somber tones of metal housings, the styrene part is molded in a lively grey that requires no additional finishing and which can easily be wiped clean when smudged.

By thus eliminating the time-consuming and costly over-all painting process which is necessary with metal housings, a savings of about 25% in the housing unit cost is achieved. Savings are also effected in the maintenance of the machine since the color is integral to the part and scratches caused by handling are hardly noticeable.

The success of the styrene housing—both from the functional and decorative standpoints—has led to plans for a more widespread adoption of the application. Executives of Clary Corp. predict that, within a short time, the inherent advantages of the high-impact styrene will lead to a complete changeover to the material in the housings of their entire line of business machines.



Photos courtesy Clary Multiplier Corp.
Molded styrene housing (upper center) serves as lightweight, durable, and decorative enclosure for the various components of adding machine

Use of plastics rather than metal housing for adding machine contributes greatly to its portability

The New Transparent Plastics

by C. R. Riley*

Miraculous materials—both acrylics and polyesters—have been developed to meet the needs of aircraft designers

APPROXIMATELY 16 years ago acrylic plastic was first used for aircraft enclosures. Since that time, with the advent of pressurization of the cockpit, the aviation industry has been forced to demand higher strength materials.

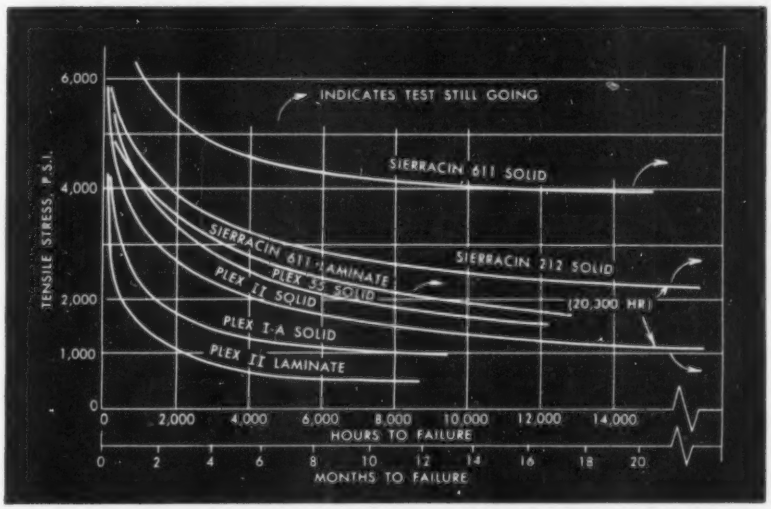
At times, the progress in design and development of better transparent material has seemed much too slow, but as the requirements became more pressing and available financing for development work was made possible, the laboratories in this country began really serious work. From this endeavor in the last few years have come some miraculous materials. But even with the great strides already made, the designers of aircraft demand still more. It has seemed that with every new advancement made by the material suppliers the aircraft designer comes up with a new and more difficult request for better and stronger transparent materials.

Basic Problems

To explain some of the problems encountered by those entrusted to develop materials of this type, it should be remembered that all transparent materials to date have the tendency of notch sensitivity, which means that they, like glass, can shatter very easily when struck a sharp blow. Another difficulty, as with acrylic plastics, is the tendency to craze. This is a minute fissuring of the surface of the material which, in time, usually propagates on through the sheet, with ultimate breakage. As a rule, a crazed sheet of plastic has lost approximately 70% of its strength and, for load carrying ability, is virtually useless.

Of all the materials now available to the aircraft designer, there is none that meets all the requirements of a perfect material. It is therefore necessary to evaluate the needs and then fit the best available material to the requirement. Of necessity, this often means a compromise on the part of the designer. It also means extensive laboratory research by the aircraft company to determine the qualities of the individual material under certain prescribed conditions. These conditions are constantly changing as new and different design applications come up, resulting in a steady work load in the laboratories. It is from this research that many interesting results have come during the past few years.

Of the materials most commonly used today by all aircraft manufacturers, all have some good points and all have definite limitation. The most universally used material is



Basic drawing courtesy Lockheed Aircraft Co.

Fig. 1—Series of graphs illustrating the comparative load-carrying capacities of laminated and monolithic acrylics and polyesters over various lengths of service life

Table I—What Aircraft Designers Want in Plastics

	Desired	*Available*
Tensile Strength at Room Temperature, p.s.i.	15,000	11,000
Tensile Strength at 200° F., p.s.i.	1500	150
Modulus of Elasticity, p.s.i.	1,000,000	500,000
Elongation at Break, %	10 to 12	2 to 5
Flexural Strength, p.s.i.	20,000	16,000
Stress Solvent Crazing, p.s.i.	none	10,000
Impact Strength (Notch Sensitivity)		
Unnotched, ft./lb.	15	1.6
Notched, ft./lb.	10	0.5 (acrylics)
		0.2 (polyesters)
Heat Distortion, °F	250	180–220
Barcol Hardness	75	48
Formability, %	50	50 (acrylics)
		10 (polyesters)

* Process Engineer, Lockheed Aircraft Corp., Burbank, Calif.

methyl methacrylate, which is extremely clear and transparent and remains so during its entire service life, providing it is not crazed from overloading or destroyed by solvents. A newer material, a transparent polyester, which is being used in limited amounts, is not quite as clear as the acrylics, but is virtually craze resistant. Its notch sensitivity is its principal drawback. For example, a piece of polyester having no notches in its tension surface will hold 30 lb. of pressure when loaded, and will break when notched or chipped on the tension side at only 3 lb. of pressure. Therefore, notches or chips have their disastrous effect on polyesters, as crazing has with the acrylics. Acrylics also are subject to notch sensitivity, but not to the same extent as the polyesters.

Improvements Desired

Designers today are asking for many improvements. A comparison of their requests with available materials is best illustrated by referring to Table I. In all fairness to the material suppliers, it should be remembered that, if and when they are able to supply the above desired conditions to the aircraft designer, it will be only a limited time before the designer will again be asking for what would seem the impossible. However, it has been this driving force for new and better materials that has spurred the laboratory technician to heights he had not in the past believed attainable.

Until materials are developed to meet the requirements of the designer, some of the steps already taken are proving successful, even though they are expensive and cause a weight disadvantage. One of these is the laminating of monolithic skins

Table II—Comparative Data on Transparent Plastics

	Acrylics					*Polyester*	
Test	*Plex Ia*	*Plex II*	*Plex 55*	*Polymer "K"*	*M.A.C.A. or Gafite*	*Selectron 44*	*Sierracin 611*
Specific Gravity	1.19	1.19	1.19	1.21	1.47	1.2	1.2
Tensile Ultimate, p.s.i.	8000	10,500	11,000	10,000	16,800	10,400	10,400
Tensile Elongation, %	5	5	5	3.6	....	3	3
Tensile Modulus, p.s.i.	400,000	420,000	425,000	460,000	800,000	550,000	550,000
Heat Distortion, °F.	165	202	219	230	270	180	180
Impact Strength (Izod)							
Plain, ft./lb.	1.4	1.61	1.41	1.40	....	1.18	1.18
Notched, ft./lb.	0.4	0.99	0.45	0.45	....	0.22	0.22
Barcol Hardness	36	49	52	55	75	44	44
Flexural Ultimate							
Plain, p.s.i.	15,000	18,000	19,000	19,500	23,000	15,500	15,500
Notched, p.s.i.	7000	8750	10,500	11,000	13,000	6500	6500
Flexural Modulus							
Plain, p.s.i.	400,000	400,000	500,000	550,000	800,000	500,000	500,000
Formability, %	50	50	50	12	50	10	10
Solvent Stress							
Iso Propyl Alcohol (seconds to craze at)							
1000 p.s.i.	....	142	none	....	....	no craze	no craze
3000 p.s.i.	....	9	330	....	....	no craze	no craze
5000 p.s.i.	....	2	20	....	....	no craze	no craze
Toluene (seconds to craze at)							
1000 p.s.i.	....	130	none	....	....	no craze	no craze
3000 p.s.i.	....	14	3750	....	....	no craze	no craze
5000 p.s.i.	....	immediate	62	....	....	no craze	no craze
Methyl Ethyl Ketone (seconds to craze at)							
1000 p.s.i.	....	8	none	....	....	no craze	no craze
3000 p.s.i.	....	2	26	....	....	no craze	no craze
5000 p.s.i.	....	1	5	....	....	no craze	no craze
Acetone (minutes to craze at)							
1000 p.s.i.	....	150	270	....	....	no craze	no craze
2000 p.s.i.	....	immediate	120	....	....	no craze	no craze
4000 p.s.i.	....	....	immediate	....	....	no craze	no craze

of plastic with a soft inter-layer of polyvinyl butyral as the center core. This reduces the tendency of the plastic to shatter when struck a sharp blow, and reacts much the same as safety glass used in modern motor cars. Although this increases the impact strength, it also increases the cost by as much as five times and at the same time increases the weight, which is of vital importance in aircraft design.

Crazing Problems

In the laminating of transparent materials, other difficulties arise. One of the most severe is that of crazing of acrylics due to the plasticizer used in the inter-layer material. This reduces the usual load carrying capacity of the acrylic when it is laminated to a maximum of 500 p.s.i. over a period of 9000 hr. of service life. On the other hand, polyesters, with their non-crazing tendency, show a load carrying capacity of 2000 p.s.i. over the same period of 9000 hr. of service life. (See Figure 1.) Impact values of both materials when laminated approach the order of 7 to 8 ft./lb. in contrast to the monolithic value of 0.5 ft./lb. for acrylics and 0.2 ft./lb. for polyesters. Laminating, therefore, is a partial answer to the difficulty of notch sensitivity.

Forming of the two basic transparent materials differs greatly. Acrylics, since they are thermoplastic by nature, are easily formed into many different shapes while still retaining excellent optical qualities. This is done by heating, which makes the sheet pliable. Polyesters are primarily thermosetting, and theoretically are not supposed to be pliable after once setting up. However, this problem was overcome, to a limited extent, by the addition to the basic polyester of thermoplastic material of sufficient amount to allow forming while in a "B" stage of polymerization.

Courtesy Plastic Age Co.

Fig. 2—Acrylic sheet being transported from the heating oven to die for the final forming operation shows relatively high degree of flexibility

Courtesy Pittsburgh Plate Glass Co.

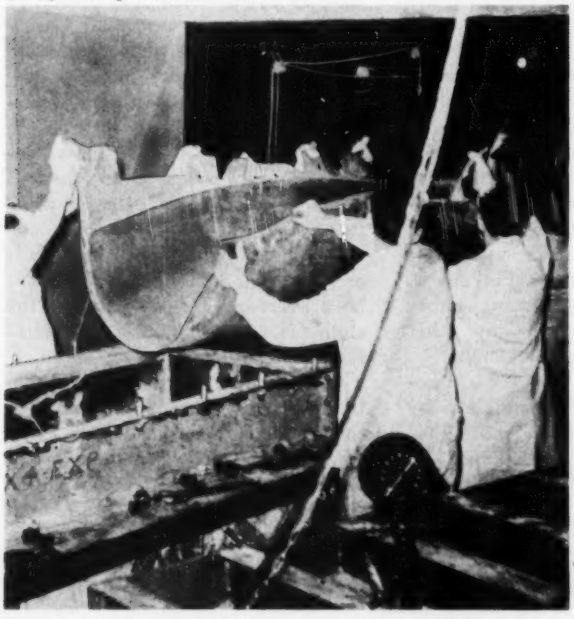


Fig. 3—For maximum formability, polyester sheet stock has to be preformed in heating oven prior to being placed in forming die

To compare the two basic materials for formability it has been customary to compare the maximum draw of a hemisphere to the diameter and express this in a percentage. If, for example, a 6-in. diameter may be drawn in a die to 3 in., we have a 50% draw, or the material is formable to a 50% range. This 50% draw is possible with the majority of acrylics, while with polyester material, 10% to 12% appears to be the maximum at this time. Figure 2 shows the flexibility of acrylic sheet stock as it is removed from the heating oven prior to insertion into the die for the forming operation. Figure 3 shows how polyester sheet must be preformed in the oven prior to placing in the die in order to obtain maximum formability. Although polyester sheet stock is more difficult to form to compound curvatures, it does have the advantage over acrylic in not picking up mark-off from the die surface while being formed. This means that it can be formed right up to the die surface, giving more accurate contours for matching fits without losing optical qualities. But the best optical qualities of polyester do not compare with the better free blown formed acrylic parts.

Acrylic and Polyester

As previously mentioned, the basic materials for transparent enclosures for aircraft are acrylic and polyester. Under the acrylic heading

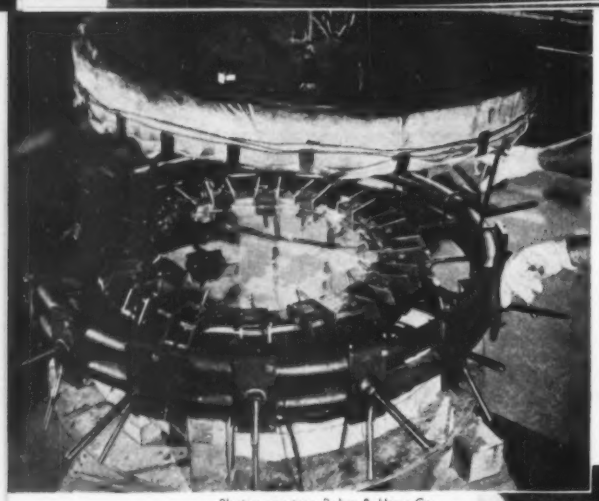
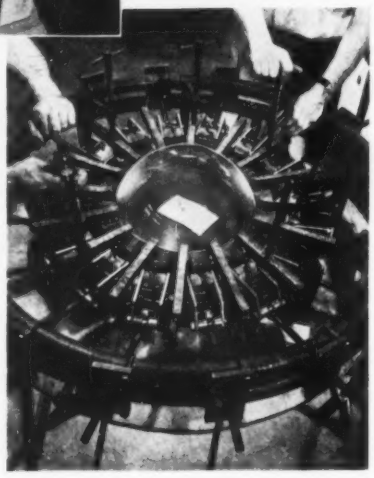


Fig. 4—Jigs are necessary in forming of prestretched acrylic to prevent return of material to "as-cast" state

Fig. 5—Jigs can later be collapsed in order to allow the material to form around the forming die

Photos courtesy Rohm & Haas Co.



come various types designed for different conditions and having a wide variation in their physical capabilities.

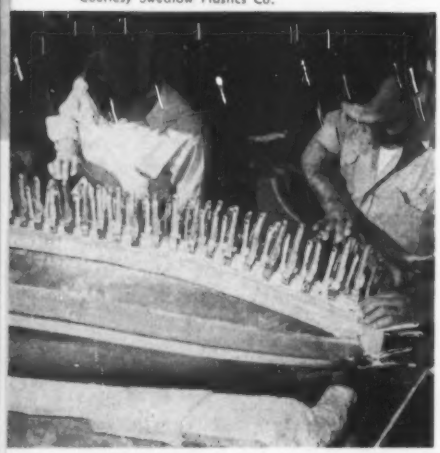
In the polyester field, there are only two and these are basically the same, although manufactured by different companies. The accompanying chart gives comparative data of the principal materials commonly used today (Table II).

As can be seen from the chart, many of the physicals requested by the aircraft designer are to be found in the material "Gafite-M.A.C.A." or more commonly known as methyl-alpha-chloroacrylate. It has a heat distortion figure of 270° F. and a tensile strength of close to 17,000 p.s.i., and is still easily formed. Its craze resistance is reasonably high and should not present too great a problem in design. However, due to the difficulties of manufacture, it is not available in production quantities and is therefore not considered at the moment as an available material.

Also on the chart is listed Polymer K, recently developed by Rohm and Haas Co., and meeting a great many of the specifications required by the designer. This material is new and not too much checking and cross checking has been completed. However, from the work accomplished thus far it holds great promise of being the next material to be specified by the designer. Although it does not compare with Gafite in some physical requirements, it will be available in production quantities in the near future and can therefore be seriously considered for new designs. Polymer K is more resistant to crazing, either stress or solvent, than any other acrylic material now available.

Rohm and Haas has recently accomplished the "impossible" by heating its standard production material, Plexiglas 55, to a formable state and stretching it biaxially, retaining its stretched position through the cooling stage. The result is a monolithic material with an impact value equal to or greater than that of laminated material. Not only is high impact gained, but cost should be reduced to a point below that of the laminate. It will also reduce the weight factor required of a laminate. The forming of pre-stretched acrylic will present somewhat of a problem due to the elastic memory of the material, tending to return to its original "as cast" shape when reheated. Forming can be accomplished by proper jigs to restrain the plastic while being heated, and later, the jigs can be collapsed to allow the material to form around the die. (Figures 4 and 5.) These problems can be worked out in time and when completed, will give the designer a possible answer to his dreams for a perfect material.

Fig. 6—Stress concentrations are eliminated by use of glass cloth laminate
Courtesy Swedlow Plastics Co.



Attaching Edges

In pressurized aircraft applications it has been found inadvisable to drill holes through the plastic itself for securing to the frame. Localized stress concentrations are so great as to create limited service life due to cracks. This has been greatly eliminated by cementing laminated glass cloth to the milled edges of the transparent material as shown in Fig. 6. Holes for attaching are drilled directly through the glass cloth laminate. This method spreads the load over a greater area thereby reducing concentrated loading and increasing service life materially.

Recently much thought has been given to the use of other fabrics such as nylon, orlon, and dacron in order to reduce residual stress caused by thermal expansion and contraction. Although none of the synthetic fabrics show the high tensile strength found in glass cloth, they will appear to give better results due to much lower thermal stresses. Another difficulty encountered with the synthetics has been one of poor wetting by the monomer during lamination. This has been overcome by pre-sizing of the cloth prior to laminating and satisfactory results are being obtained.

Considering the short span of time for development of plastics in comparison to older and more common materials, the plastics industry has made remarkable strides. Given equal consideration, plastics should make even greater advancements in research and development during the next few years.

Extruded Styrene Alloy Sheet

New production capacity extends application potentials of vacuum-formable material

RIGID plastic sheet material, heralded as having unusual properties and excellent low-cost forming characteristics, was announced recently by the Campco Div., Chicago Molded Products Corp. Known as Campco S-300, the material is an alloy of polystyrene and rubber extruded through specially designed continuous equipment to produce, in a single operation, a material having a smooth surface and a high gloss finish. It can be supplied in any desired length in widths ranging from 26 to 58 inches, and in thicknesses ranging from 0.005 to 0.125 inches. Available color selection is reported to be unlimited.

The combination of styrene and rubber produces a sheet that has high impact strength without sacrifice of formability. In addition, the sheet machines easily, and is dimensionally stable since its water absorption is low. Forming is simple, usually being accomplished by heating the sheet to a predetermined temperature, then snapping it into final shape by applying vacuum through a low cost die. Even the minutest detail in the mold can be reproduced in the formed sheet.

According to Edward Bachner, vice president of Campco Div., Campco S-300 can compete in many applications with conventional sheet steel, aluminum, wood, paperboard, fiberboard, glass, injection molded plastics, and can even replace fabric in applications where the fabric serves as a liner (car-roof interiors, for example). Its use would, of course, be governed by sound engineering and production reasons: it could serve only light structural purposes, yet for formed parts like refrigerator door liners, it can easily justify its selection because of its built-in glossy finish and color, insulating value, high impact strength, and ease of cleaning and handling. In addition to door liners, the refrigeration industry is looking with interest at preliminary production in a number of vacuum forming plants of such other parts as food trays and drip pans.

Extruded plastics sheet is, of course, not new in the plastics industry. Cellulose acetate, cellulose acetate butyrate, ethyl cellulose, and rigid vinyl have been available for some time. But the styrene-rubber "alloys" are a new entry. And Campco's reported production capacity of 500,000 lb. per month should make it the largest potential supplier in the field. Display and packaging items have been formed of the cellulose and vinyl materials for a number of years, but the big lift in formed sheet products has awaited large-scale availability of the styrene alloy sheet and vacuum-forming combination.

Poundage cost of Campco sheet is lower than that of rigid vinyl or any of the cellulosics. As the specific gravity of Campco sheet is also low, the material has an additional advantage in cost per square foot. Also, there is no chance of plasticizer loss, and consequent lowering of desirable properties.

Applications

Among the many applications now being studied are automotive interior panels, seat backs, automotive interior roofing, aircraft instrument panels, aircraft seat components, machine housings, baggage racks, luggage, desk and table tops, chairs, scuff pads, drawers, industrial ducting, food handling trays and shelves, air conditioner housings and grilles, tote boxes, machine parts, and wall tile. The availability of the new sheet in translucent form opens up potentials in interior lighting fixtures, reflectors, and illuminated signs. It is not recommended at present for exterior use since ultraviolet rays can cause slight yellowing of the sheet.

The surface of the material is reported to be particularly suitable for printing, lithographing, and silk-screening. In translucent form, printed sheets can be overlaminated with a thin sheet of the same material to protect against wear and handling, an advantage for advertising signs, colorful containers, and three-dimensional displays which combine printing with forming.

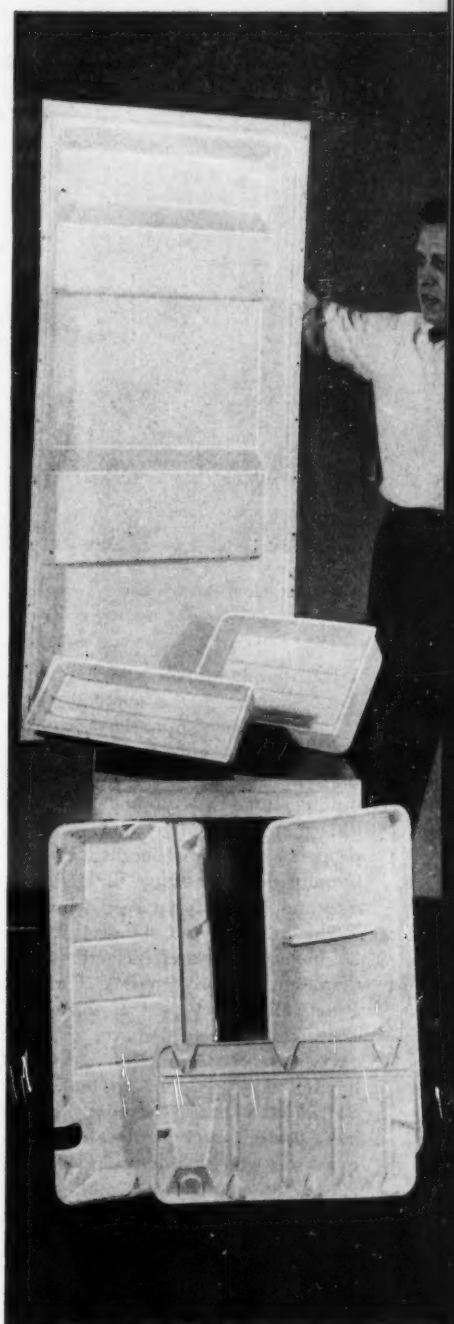


Photo courtesy Chicago Molded Products Corp.

Styrene alloy rigid sheet finds ready application in vacuum forming of refrigerator door liners, food trays, and drip pans because of its gleaming surface, light weight, insulating efficiency, and high moisture resistance

ALL-WEATHER HUMIDITY

All photos courtesy Admiral Corp

Except for the mechanism and the metal frame of Admiral's combination humidifier-dehumidifier, unit is almost entirely made of molded styrene and styrene copolymer parts

THE dominant role which plastics are gaining in the appliance field is once more emphasized by the new moisture conditioner just introduced by Admiral Corp. This unique dual-role appliance makes life more bearable and protects property and merchandise by optionally dehumidifying air in summer and humidifying it in winter.

The Admiral unit stands just over 23 inches high and has an overall diameter of approximately 16 inches. Practically every part of the appliance which meets the eye, with the exception of the metal base and handle, was designed to make use of molded plastics. Included are the large outer shell or housing, with integrally molded circular louver across the top; the drip pan, having a capacity of three gal.; and the leg support covers, nameplate escutcheon, and control knob. In addition, there are other plastics parts which are not visible in the final assembly — a circular ring mounted above and inside the molded housing, an orifice ring in the upper section of the housing, and a control shaft cam whose function is to raise and lower the heater assembly.

The moisture container is made in two models. Both are built to the same general specifications, except that the Model DCH-5 both dehumidifies and humidifies, while the Model DC-5 is equipped for dehumidification only. For the humidifying cycle, a pivotal heater is immersed in a removable water container which fits beneath the leg supports of the appliance. This evaporates the water and a fan circulates and distributes the moisture-laden air — as much as 2 gal. every 24 hours. When all the water in the container has been evaporated, the heater turns off automatically. With the switch turned to "Dehumidify," the unit will remove up to 3 gal. of water from the air every 24 hours.

Main structural member of the moisture conditioner is of stamped aluminum. It consists of the base plate and two vertical members that are riveted to the base and rise to the top of the assembly, where the aluminum carrying handle is mounted. An "O" shaped section of aluminum mounts the refrigeration system and fan assembly and in turn is fastened between both vertical members. The large outer housing is placed over this framework and fastened to it by the handle mounting screws and a screw into the control mounting bracket.

Integral color, light weight, functional design opportunities, moisture resistance, and absence of corrosion problems were among the qualities which appealed to Admiral engineers in specifying molded plastics for major components of the new appliance, which is the first "two-way" unit of its type to reach the market. Weighing slightly more than 50 lb., the unit is easily carried to any desired location by means of the handle at the top. It is powered by a hermetically sealed motor which never requires oiling and has a five-year warranty.

Production Details

Largest and most unusual of the plastics parts is the outer shell or housing, molded of Kopper's styrene copolymer in a mottled beige color. The modern styling of this component is punctuated by a series of circumferential ridges which provide a pleasing design detail and contribute added strength. Another interesting design and construction detail of this component is the integral louver at the top, which eliminates an extra assembly operation. This housing is molded by Sinko Mfg. & Tool Corp., Chicago, Ill., on a 60-oz. Watson-Stillman injection machine and tips the scales at approximately 61 ounces. The tool for this was made by Enduro Tool & Engraving Co., Chicago.

The housing, produced in a single-cavity mold, is gated at the center of the louver or grille from the cavity side, necessitating extremely close control of the molding operation and regulation of temperature. Mold temperature control is maintained at three points, including provision for independent temperature control of that area of the die where the louver is produced. The essential problem involved was the fact that the material required to fill out the relatively heavy walls of the housing must pass through the

CONTROL

New appliance, with major parts designed for plastics, humidifies the atmosphere in winter, dehumidifies it in summer

single sprue and out through the ribs of the louver, which itself must be of relatively open design in order not to block the flow of air in the finished appliance. Originally, the louver was designed with six radial ribs, but this number was increased to 12 in order to provide improved distribution of the plastics material.

A molding cycle of approximately 1 min. is obtained on this large piece, which has a depth of 16 inches. One side core is made in the part, through which the control knob is mounted to the appliance. Following the molding operation, the sprue is milled off, making an extremely neat finished part.

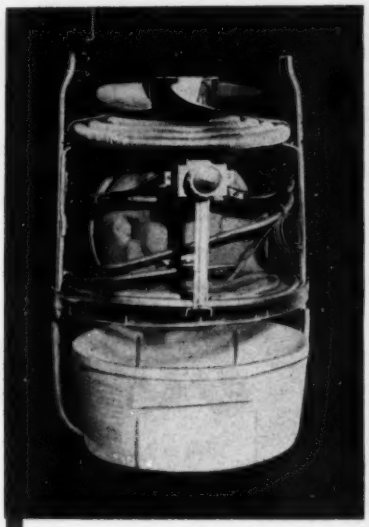
Next in size is the clear styrene drip pan, measuring 13 in. in diameter by 5 in. deep. It is produced on a 24-oz. Reed-Prentice injection machine by Plastic Molded Products Co., Chicago, using Dow heat-resistant material. This piece is sand blasted on the inner surface after molding, so that the water level in the container can be clearly observed from the outside. The container is made with two handles on the side for easy lifting and emptying, and two slots in the bottom which index it to the proper position on the metal base when it is placed beneath the appliance.

Three-Purpose Part

Above and inside the bottom of the large housing is a circular ring molded of Dow styrene copolymer, also produced by Plastic Molded Products. This component serves three purposes: it collects any condensation that may form on the inside of the housing, directing the water thus formed into the water container; secondly, it directs the air so that it passes over the evaporator plate; and finally, it acts as a support to keep the bottom of the plastics housing in proper position.

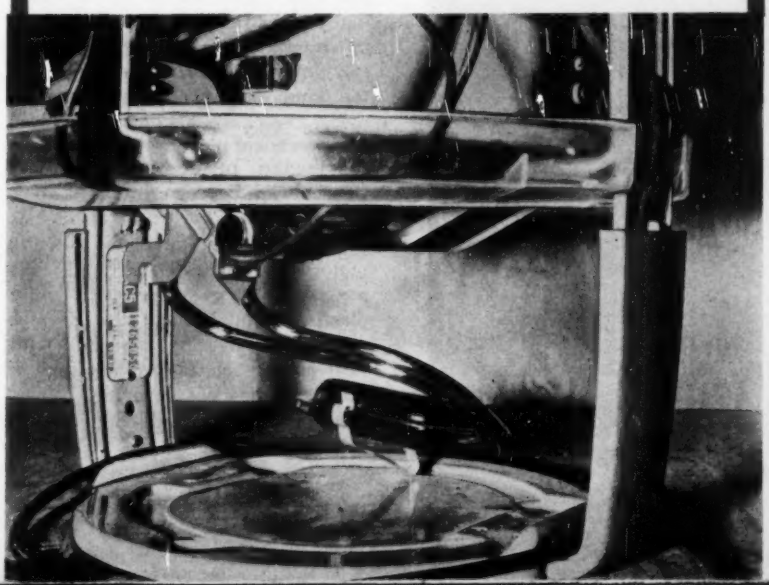
The leg support covers, molded of Kopper's styrene copolymer by Sinko, are fastened to the vertical support members by a snap-in arrangement near the top of the piece and a holding screw near the bottom. They are made in a two-cavity mold. The escutcheon plate and control knob, both supplied by Plastic Molded Products, are of styrene; the escutcheon plate is molded in clear transparent material, finished on the back surface by a mask-and-spray operation, while the lettering and background are finished by vacuum plating.

Other plastics parts used in the new Admiral moisture conditioner include a styrene orifice ring which is mounted in the upper section of the housing, the purpose of which is to increase the flow of air through the system, and a styrene cam which is mounted on the control shaft of the appliance, both molded by Sinko. The purpose of the cam is to raise and lower, through a linkage system, the electric heater assembly used on the unit.



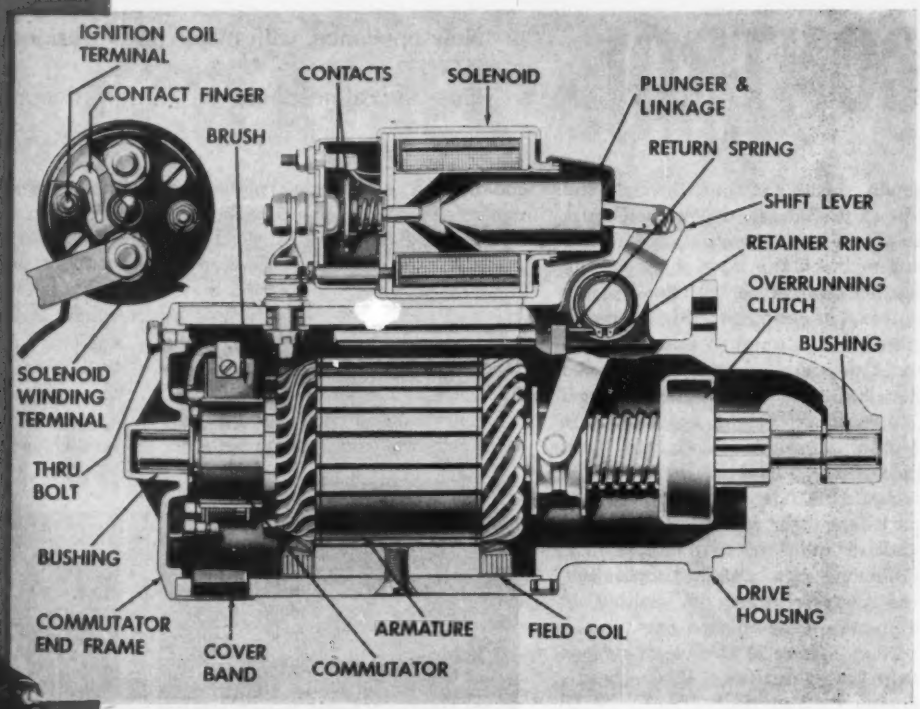
Unit without cover. Copolymer ring above styrene pan aids direct air flow

Molded copolymer leg covers, one shown in position (left), add to style



Close-up of plastic support ring and molded copolymer covers for vertical leg supports. Bottom of support ring slopes so that condensed moisture drains into drip pan below

Cut-away view of automotive starter, motor indicates location of field coils, brushes, and solenoid switches—all components utilizing several types of plastics material



Vinyl plastisol coating on field coils in starting motor is flame resistant, heat-stable, and impervious to many chemicals

Vinyl plastisol coating, replacing insulating cloth, protects coils in the starter motor; other plastics bring the electrical system closer to perfection

When Your

SEVERAL plastics, including vinyl plastisol, ethyl cellulose, nylon, and medium-impact phenolic, are utilized by Delco-Remy Div., General Motors Corp., Anderson, Ind., in the manufacture of the cranking (starter) motors and the generators which keep the car battery charged.

These applications emphasize the fact that while plastics in the automotive field have recently made much progress in the form of upholstery materials, decorative emblems, tail lamp lenses, and other visible parts, there are also many important electrical plastics applications in the modern motor car which may never even be seen by its owner.

One of the newest uses of plastics by Delco-Remy involves starting motor field coils. These field coils are now being coated with vinyl plastisol, supplanting the former method of covering the coils with heat-sealing cloth. Advantages of the gray plastisol covering, Delco-Remy reports, include high resistance to gasoline and other petroleum products, water, organic and mineral acids, and alkalis. Furthermore, the plastic material has excellent resistance to abrasion, good heat stability, and is flame resistant.

Conveyorized Process

In the coating process, the coils are hung on a chain conveyor set to move at five ft. per minute. Coils are preheated to an indicated temperature of 480° F. for five min., to permit a heavier coating. After being dipped in the plastisol formulation, they are baked for 45 min. at an indicated temperature of 360° F. The baking oven used in this operation has a capacity of 6600 coils per hr. and is located on the roof of the building in order to eliminate fumes and heat from the interior of the plant. The finished plastic coating measures 0.050 in. thick at its thickest point.

For coating generator field coils, Delco-Remy uses an ethyl cellulose

Uncoated cranking motor field coils are hung on chain conveyor prior to being automatically dipped in plastisol formulation and baked

Field coil before coating (top), and same coil after coating and baking

Coils are removed from chain conveyor after the baking operation

Car Starts

base gel lacquer coating mixture consisting of ethyl cellulose, plasticizer, solvent, resin, and red dye. These materials are mixed and agitated in a heated tank maintained at 215° F. The gel lacquer is made by using a solvent for the plastics materials in which the plastic will be in solution only at elevated temperatures (approximately 200° F.). Solvency power of the solvent is so adjusted that when the mixture is cooled to approximately 160° F. a gel results. As the coils are dipped cold, the chill effect produces a uniform gel around the coil. The solvent is then baked out to the extent that the final plastic film is uniform and thinner than the original gel coating.

Automatic Control

After being prepared, the plastic dip material is pumped to a reservoir tank where it is constantly agitated at 215° F. until needed, then pumped to the dip tank as required. The temperature and viscosity of the material in the dip tank are automatically controlled by a unit which makes a record of both factors, adding solvent to the plastic as needed. Following the dipping process, the coils are baked for 75 minutes at 160° F., after which the oven temperature is raised to 250° F. Total baking time is 2½ hours. The two-stage baking procedure is necessary to remove the majority of the solvent without causing surface pinholes or bubbles in the coating.

In addition to the vinyl plastisol coating used on the field coils, the starting motor includes nylon terminal insulation for the solenoid switch, nylon washers in the switch, and nylon bushings for coil wire lead-outs from the switch. Medium-impact phenolic material, molded on the end of the brush pins, marks a further application of plastics in the starting motors. An accompanying diagram indicates the location of these various plastic components.

What You Should Know About

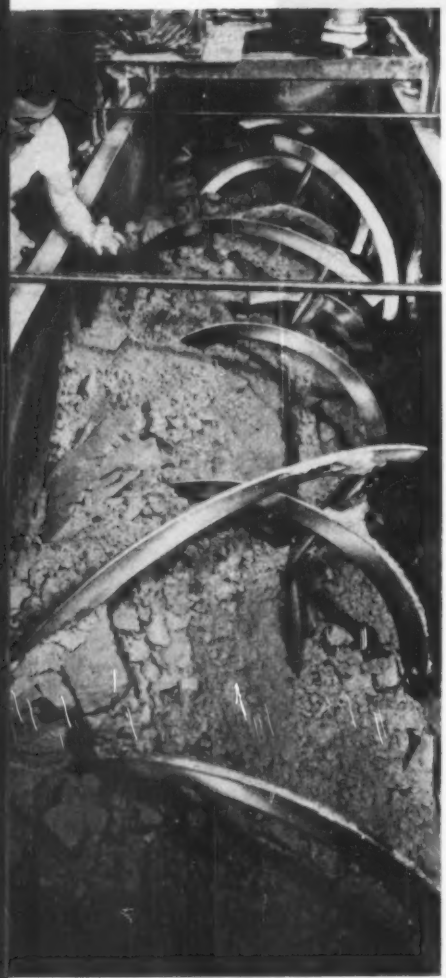
PLASTICIZERS FOR VINYLS

by J. J. Morris*

As the plasticizer industry continues to broaden, it also becomes more complex. And at the same time it assumes greater importance to everyone concerned with vinyls. No longer can the end user of vinyls afford not to know the basic facts about the various members of the plasticizer families and what each has to offer.

The accompanying article is the first of a series of three which will present these facts. It deals with the types of plasticizers used with vinyl chloride film and sheeting. Succeeding articles will cover plasticizers for vinyl extrusion compounds and for dispersions.

For permanent reference, the reader should consult the Plasticizers Chart on page 784 of the recently published "1953 Modern Plastics Encyclopedia."



Plasticizers and other materials are mixed with vinyl resin in a preblender

THE plasticizer industry may be regarded as the precocious smaller brother of the vinyl chloride resin industry. While the consumption of plasticizers will always remain approximately one-half that of vinyl chloride and vinyl copolymer resins, the "personality" of flexible vinyl plastics is largely determined by properties imparted by these plasticizers.

Since vinyl plastics may be processed into such diverse articles as calendered film for baby pants, upholstery sheeting, and floor tile; extruded intravenous tubing, garden hose, and electrical insulation; slush molded doll parts, rain boots, industrial gloves, and athletic pads, it is not surprising that over 100 plasticizers are consumed in commercial quantities by vinyl chloride processors. More than 30 manufacturers participate to various extents in selling to the vinyl plastics industry approximately 184,000,000 lb. of plasticizers valued at over $60,000,000. The U.S. Tariff Commission preliminary report on production and sales of all plasticizers in 1952 is given in Table 1, facing this page.

To be of interest to this large industry, plasticizers are expected to exhibit good compatibility; low volatility; freedom from odor; chemical, heat, and light stability; and resistance to extraction by water and other liquids. In special instances a low order of toxicity, resistance to burning, good electrical properties, or the ability to impart excellent low-temperature flexibility can be the determining factors in motivating choice of plasticizers.

Classification

The vinyl plasticizer industry with its multiplicity of products, wide range of properties to be derived from its products, and host of competing manufacturers would be incomprehensible to all except a select inner circle of "experts" were it not for the fact that plasticizers can be classified by the nature of their chemical molecules or their function as plasticizers. Further simplification is made possible by the fact that all vinyl plastics products can be segregated into three broad divisions depending on the nature of the equipment used to fabricate consumer items or the nature of the resins used. These three divisions are: 1) calendered products; 2) extruded products; 3) products prepared from dispersion resins through plastisol or organosol techniques.

Plasticizers themselves may be arranged in six families as follows: 1) phthalates; 2) phosphates; 3) low

* Carbide and Carbon Chemicals Co.

Table I—United States Production and Sales of Plasticizers, 1952

Chemical	Production	Sales		
		Quantity	Value	Unit Value
	1000 lb.	1000 lb.	$1000	Per lb.
GRAND TOTAL	266,957	201,566	$75,039	$0.37
PLASTICIZERS, CYCLIC				
Total	194,362	144,539	51,126	.35
Phosphoric acid esters:				
Tricresyl phosphate	18,031	16,485	5,667	.34
Triphenyl phosphate	5,758	—	—	—
Phthalic anhydride esters, total	149,826	105,237	38,151	.36
Dibutyl phthalate	17,881	12,475	4,224	.34
Dicapryl phthalate	5,246	5,220	1,804	.35
Diethyl phthalate	12,138	9,193	2,512	.27
Di(2-methoxyethyl) phthalate [Di(methyl cellosolve) phthalate]	1,576	—	—	—
Dimethyl phthalate	2,901	3,005	837	.28
Diocytl phthalates, total	86,857	54,320	20,592	.38
Di-2-ethylhexyl phthalate	63,236	38,082	14,510	.38
Di-iso-octyl and di-n-octyl phthalates	23,621	16,238	6,082	.37
All other[1]	23,227	21,024	8,182	.39
All other cyclic plasticizers[2]	20,747	22,817	7,308	.42
PLASTICIZERS, ACYCLIC				
Total	72,595	57,027	23,913	.47
Adipic acid esters, total	7,277	5,061	2,388	.44
Di-2-ethylhexyl adipate	3,204	1,886	826	.32
Di-iso-octyl adipate	1,125	899	399	.44
All other[3]	2,948	2,276	1,163	.51
Lauric acid esters, total	1,050	959	356	.37
Glyceryl monolaurate	164	—	—	—
Polyethylene glycol mono- and dilaurate	233	224	88	.39
1,2-Propylene glycol monolaurate	181	—	—	—
All other[4]	472	735	268	.36
Oleic acid esters, total	6,645	3,617	1,132	.31
Diethylene glycol mono-oleate	439	329	115	.35
Glyceryl mono-oleate	662	663	222	.33
Polyethylene glycol mono-oleate	559	203	78	.38
All other[5]	4,985	2,422	717	.30
Phosphoric acid esters[6]	8,991	5,779	2,664	.46
Ricinoleic and acetylricinoleic acid esters[7]	4,295	—	—	—
Sebacic acid esters, total	5,653	4,652	3,661	.79
Dibutyl sebacate	2,215	—	—	—
Di-iso-octyl and di-2-ethylhexyl sebacate	3,004	3,056	2,253	.74
All other[8]	1,434	1,596	1,408	.88
Stearic acid esters, total	16,245	14,681	4,402	.30
Butyl stearate	1,802	1,618	394	.24
Diethylene glycol monostearate	458	416	114	.27
Ethylene glycol monostearate	310	322	107	.33
Glyceryl monostearate	8,823	7,789	2,337	.30
1,2-Propylene glycol monostearate	186	172	64	.37
All other[9]	4,666	4,364	1,386	.32
All other acyclic plasticizers[10]	22,519	22,278	9,310	.42

[1] Includes data for butylbenzyl, castor oil, diallyl, and dicyclohexyl phthalates, and for phthalic anhydride esters of cellosolves, phenols, and polyhydric alcohols.
[2] Includes data for synthetic camphor, coumarone-indene, toluenesulfonamides, phosphoric and sebacic acid esters, tetrahydrofurfuryl oleate, and other cyclic plasticizers.
[3] Includes data for adipic acid esters of cellosolves and polyhydric alcohols.
[4] Includes data for lauric acid esters of methyl and butyl alcohols, and of glycols and cellosolves.
[5] Includes data for butyl, butyl cellosolve, methyl and propyl oleates, glyceryl trioleate and other esters of oleic acid.
[6] Includes data for tributyl, triethyl, trioctyl, and tributyl (cellosolve) phosphates.
[7] Includes data for ricinoleic and acetylricinoleic acid esters of mono-, di-, tri-, and polyhydric alcohols, and cellosolves.
[8] Includes data for diamyl, dicapryl, dimethyl, dinonyl sebacates, and for sebacic acid esters of cellosolves.
[9] Includes data for stearic, monohydroxystearic and chlorostearic acid esters of mono-, di-, and polyhydric alcohols, and cellosolves.
[10] Includes data for butyl and isopropyl myristates, diethyl and isopropyl maleates, glycerol and glycol esters of fatty acids, and esters of azelaic, citric, palmitic, pelargonic, tartaric, and other acids.

temperature plasticizers; 4) resinous plasticizers; 5) miscellaneous or special purpose plasticizers; 6) plasticizer extenders.

Table 2 identifies the more important members of each family and estimates consumption for the calendar year 1952. The phthalates account for 55% of total consumption. Their dominance has been long established because they provide the best average of general properties sought in plasticizers and are economically priced. Di-2-ethylhexyl phthalate (DOP) is the bellwether of the phthalates, accounting for 60% of all phthalates because it typifies all the good properties to be obtained from phthalates. Phosphates are generally used where flame resistance is required, although ethylhexyl diphenyl phosphate is frequently chosen where low toxicity is a factor. Resinous plasticizers are employed where non-volatility and resistance to extraction are important. There are great variations within this resinous plasticizer group, with individual plasticizers imparting properties ranging from moderate resistance to extraction up to the superior resistance shown by Flexol plasticizer R-2H and Paraplex G-25. Extenders are used where reduction in cost can be achieved without seriously degrading the performance characteristics of the goods produced.

Low - temperature plasticizers broaden the usefulness of vinyl plastics by moderating stiffening effects at low temperatures and by imparting such properties as desirable hand and drape to film and sheeting. It should be noted that tri-2-ethylhexyl phosphate is classified with the low-temperature plasticizers rather than the phosphates. This plasticizer is unique because it spans two families. It provides flame resistance, as phosphates should, and, in addition, develops unsurpassed low-temperature flexibility, a characteristic not found among other usable phosphate esters.

Table II—The More Important Members of the Plasticizer Families for Vinyls

Types of Plasticizers	*Estimated Consumption 1952 in Pounds*	*Prominent Members of Family Groups**
Phthalates	105,000,000	di-2-ethylhexyl phthalate (DOP) di-iso-octyl phthalate (DIOP) dicapryl phthalate (DCP) n-octyl, n-decyl phthalate didecyl phthalate butyl benzyl phthalate butyl cyclohexyl phthalate di-2-ethylhexyl hexahydrophthalate mixed 8 carbon alcohol phthalate
Phosphates	30,000,000	tricresyl phosphate; ethylhexyl diphenyl phosphate; cresyl diphenyl phosphate; tributoxyethyl phosphate
Low-temperature Plasticizers	20,000,000	dioctyl sebacate; various dioctyl adipates; dioctyl azelate, ricinoleates; glycol esters of ethylhexoic acid; pelargonic acid, and vegetable oil fatty acids; tri-2-ethylhexyl phosphate
Resinous plasticizers	15,000,000	GE 2557; Plastolein 9720 and 9715; Paraplex G50, G40, G25, G53, G60, and G62; Flexol plasticizer R-2H
Miscellaneous or Special purpose plasticizers	8,000,000	diethylene glycol dibenzoate; tributyl acetyl citrate; Monoplex S38; Flexol plasticizer 8N8; methyl pentachlorstearate; nitrile rubber
Plasticizer Extenders	8,000,000	chlorinated paraffins; HB40 Sovaloid G; alpha methylstyrene resins; Paraflex BN-1
Total	186,000,000	

* Trade-marks are used in instances where chemical names are not known or where the use of chemical names would tend to confuse rather than inform the reader.

Miscellaneous Group

All attempts to characterize and classify the components of a vigorously growing and many sided industry must run into some difficulties. The miscellaneous group of plasticizers illustrates this fact. Some of the products in this group may be used for many of the functions performed by phthalates. It was, however, more convenient to establish them as a separate class.

Plasticizer choice is not limited to consideration of properties and economics. Because calendering, extrusion, and dispersion resin techniques are by no means simple, the choice of plasticizers must be such that efficient production is promoted or at least not hindered. Formulations must also be designed to protect consumer articles during shipment and warehousing. There should be no tendency for vinyl plastics to crack in winter or become tacky during a hot, humid summer. A film designed for use as a drapery in a Turkish bath, if such things are used in Turkish baths, need not be expected to perform satisfactorily at —70° C. However, it is possible that a film of this type may be in transit in freezing weather and some measure of low temperature flexibility must be provided.

Vinyl Film

Calendered vinyl film is produced in thicknesses up to 10 mils and is fabricated into a wide variety of consumer products. The range of such articles is now so extensive that it is doubtful that anyone connected with the industry could name all the types in a half hour test period.

Di-2-ethylhexyl phthalate (DOP) has been the backbone of vinyl film processing from the early days of this industry. This dominance was achieved because DOP supplied the best average of desired properties at a reasonable economic level. DOP permitted smooth calendering, provided excellent stability and reason-

able low-temperature flexibility, did not interfere with printing ink adhesion, and was sufficiently non-volatile that samples of film prepared 10 years ago are still in good condition. Today, DOP continues to dominate the plasticizers used in vinyl film but now shares some of the market with its "octyl" phthalate competitors, di-iso-octyl phthalate, octyl decyl phthalate, and dicapryl phthalate.

An excellent standard film could be based on a compound containing approximately 32% of DOP on total film weight. This type of product, if properly stabilized, could be used for almost every type of consumer goods made from vinyl film. However, some film manufacturers formulate with other plasticizers to obtain special properties. Tricresyl phosphate or other aromatic phosphates may be used in conjunction with one of the octyl phthalates to obtain greater flame resistance in film intended for drapery use. While the introduction of tricresyl phosphate improves flame resistance, draping characteristics and low-temperature properties are adversely affected and another compromise in plasticizer choice must be introduced. A low-temperature plasticizer such as an adipate, sebacate, ricinoleate, or glycol-alipihatic acid ester is used to restore the properties which were forfeited through using tricresyl phosphate. The final formulation chosen might consist of a plasticizer blend containing 65% octyl phthalate, 20% tricresyl phosphate, and 15% of a low-temperature plasticizer.

Raincoats, baby pants, pressure-sensitive tape, and fisherman's wader boots are products which are familiar to everyone. They may serve to illustrate compounding variations. One or more vinyl plastics raincoats are owned by virtually every American family. They are not intended for use in freezing weather but cognizance must be taken of the fact that they are frequently used at temperatures approaching 32° F. and also in the summer when the temperature may be 90° F. or above. It is therefore important that film for this use remain pliable at about 32° F. and still not soften or become tacky at 90 to 100° F. Naturally, DOP or one of the other octyl phthalates becomes the keystone of the formulation. However, 15 to 20% (of total plasticizer weight) of a low temperature plasticizer may be used to provide a product showing minimum changes in stiffness over the expected service temperature range. Because economy is important in this type of product, a plasticizer such as polyethylene glycol di-2-ethylhexoate, an adipate, or a glycol pelargonate might be used.

Photographs with this article courtesy Bakelite Co.

Successful use of vinyl film and sheet in the home—many applications are shown in this modern bedroom—depends to a large degree on the plasticizers selected

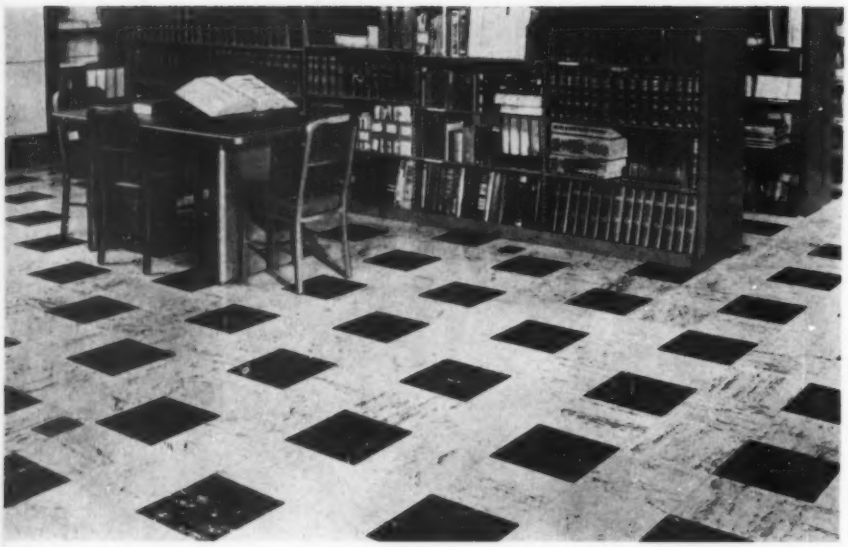
Plastic baby pants are frequently laundered in an automatic washing machine and are subject to the extractive action of soaps or synthetic detergents. If plasticizer extraction is high after several washing cycles, the baby pants become excessively stiff and unattractive. Because of this, vinyl film manufacturers may choose to balance DOP with a resinous plasticizer such as Flexol plasticizer R-2H or Paraplex G-25 to produce a superior product without increasing costs unreasonably.

A special consideration exists in pressure-sensitive tapes wherein the plasticizer or plasticizer blend used must not migrate into the adhesive and thus weaken the bond between the adhesive and the plastic film. Since a tape of this nature may be stored for considerable periods of time before use, the plasticizer property of greatest significance is resistance to migration. Resinous plasticizers such as Flexol plasticizer R-2H and Paraplex G-25 are used where the most exacting performance characteristics are sought.

Fishermen's waders are designed for use in surf or cold running streams. Resistance to water extraction and the ability to retain good flexibility in cold water are of primary importance in choosing plasticizers for this application. Formulations may be based entirely on low-temperature plasticizers such as the dioctyl adipates, azelates, sebacates, or tri-2-ethylhexyl phosphate. A second and less expensive method of formulating involves the use of one of the octyl phthalates in conjunction with one of the low-temperature plasticizers listed above. Emphasis would be placed on the low-temperature plasticizer part of the blend.

Vinyl Sheeting

Calendered vinyl sheeting is generally produced in 12- and 20-mil thickness, though floor tile, which may be considered a special division of calendered vinyl sheeting, is produced in thicknesses up to ⅛ inch. Handbag sheeting, household and



Growing popularity of vinyl floor tile in home and industry is one of the brightest prospects for the increased sale of plasticizers over the next several years

industrial upholstery sheeting, and flooring compounds may be produced with many different types of plasticizer blends. Handbag sheeting must not only be attractive looking but pleasant to feel as well. Low-temperature plasticizers are noted for their ability to impart attractive hand to vinyl plastics and are therefore included in most handbag formulations. At the same time, all low-temperature plasticizers may be regarded as active in their tendency to mar lacquered surfaces. Since there is always the possibility that handbags may be laid on lacquered pianos, desks, tables, or bureaus, the handbag sheeting manufacturers must maintain a fine balance between good hand and non-marring characteristics. This is achieved by skillful blending of octyl phthalates with low-temperature plasticizers to gain optimum performance characteristics.

Plasticizers used in vinyl upholstery must not exhibit "rub-off" tendencies

Identical standards need not apply to all types of upholstery sheeting. Stress on performance requirements can be quite different depending on the end use for which the sheeting is intended. A manufacturer could conceivably offer products containing several variations of a basic plasticizer blend in order to produce upholstery goods designed for passenger automobiles, truck seats, bar stool seats, breakfast set chairs, or household furniture.

A primary consideration in passenger automobile upholstery might be resistance to cracking at low temperatures encountered in northern climates during severe winter weather. Truck seats should be expected to exhibit superior resistance to oils and greases and this could be achieved through the use of some resinous plasticizers.

Manufacturers of upholstery sheeting are constantly trying to improve both the beauty and durability of their products. Beauty is primarily a question of styling. Durability can be a function of plasticizer choice and plasticizer permanence. For a considerable period of time, plasticizer losses were associated almost entirely with volatility. It is now conceded that volatile loss of plasticizers from upholstery sheeting is a minor factor in failures as long as discretion has been exercised in the original choice. In this instance, discretion would indicate that plasticizer selection should be limited to products which are not substantially more volatile than di-2-ethylhexyl phthalate. In any case it should be noted that volatility is a matter of evaporation into the air; if the volatility is too great the film may become stiff. Volatility has no relationship to "rub-off" or to "migration" whereby certain types of plasticizers may have a tendency to rub off on clothing or migrate to "join-up" with other materials such as certain chemicals often used in furniture varnish.

Plasticizer "Rub-Off"

All indications point to plasticizer "rub-off" as the most significant factor responsible for upholstery failures. This implies that clothing, in conjunction with the pressure exerted by the weight of a person sitting on a chair, exerts a wicking action on the plasticizers contained in vinyl sheeting. Repeated removal of small quantities of plasticizers results in gradual stiffening and sometimes in the development of cracks. Several accelerated laboratory test methods have been developed to determine the "rub-off" resistance of various plasticizers. The data obtained from these tests must be correlated with the known service life of commercial sheeting to establish the degree of reliability of the tests.

Comparison of plasticizers on an equal weight basis in a vinyl compound is not a reliable index of performance because this method of comparison fails to consider plasticizer efficiency, hardness of compounds, and cold-crack resistance. One method of approaching this problem would be to settle on a desired hardness and formulate with individual plasticizers and plasticizer blends to produce sheeting to meet the requirements. Samples

(*Continued on p. 214*)

International Plastics Meetings

I.S.O. and I.U.P.A.C. sessions in Stockholm

SIX Draft Proposals of testing methods to be recommended for use in international trade were approved at a meeting of Technical Committee 61 on Plastics, International Standardization Organization, held in Stockholm, Sweden, August 10 to 14, 1953. These methods of test pertain to the determination of water absorption, apparent densities of molding powders (pourable and nonpourable from a funnel), acetone-soluble matter of phenolic moldings, flexural strength properties, and temperature of deflection under load. In addition, progress was made on the international standardization of test methods for many other properties, of standard laboratory atmospheres and conditioning procedures for use in testing, and of nomenclature and listing of equivalent terms in various languages.

The International Standardization Organization (I.S.O.) is made up of the national standardization organizations of about 35 countries. It has Technical Committees working in diverse fields of materials and products. The American Standards Association (A.S.A.) is the Secretariat for the I.S.O./T.C. 61 on Plastics and, in collaboration with A.S.T.M. Committee D-20, is responsible for scheduling and conducting the work of the plastics committee. The Draft Proposals prepared by I.S.O./T.C. 61 are circulated by the A.S.A. to the participating member bodies (13 in the case of I.S.O./T C. 61) for consideration. When a Draft Proposal is approved by a majority of these organizations, it becomes a Draft I.S.O. Recommendation and is submitted to all I.S.O. member bodies for consideration. When it is accepted by a majority of the I.S.O. member bodies and the I.S.O. Council, it becomes an I.S.O. Recommendation; if accepted by all the I.S.O. member bodies, it becomes an I.S.O. Standard.

This was the third meeting of I.S.O./T.C. 61, the previous meetings having been held in New York in 1951 and in Turin, Italy, in 1952. Dr. G. M. Kline was chairman of the meeting and Dr. H. Liander, Technical Director of A.S.E.A., Sweden, was co-chairman. Twelve countries were represented at the Stockholm meeting with the following number of delegates: Belgium, 3; Denmark, 1; France, 5; Germany, 7; India, 1; Italy, 5; Netherlands, 4; Norway, 1; Sweden, 14; Switzerland, 2; United Kingdom, 9; and United States, 6. Robert Burns, Bell Telephone Laboratories, was leader of the U. S. delegation, which included the following additional members; Dr. R. Buchdahl, Plastics Div., Monsanto Chemical Co.; Dr. F. W. Busse, Polychemicals Dept., E. I. du Pont de Nemours and Co., Inc.; Dr. G. M. Kline, National Bureau of Standards and Technical Editor, MODERN PLASTICS; Dr. Ralph Witt, N.E.M.A. and Johns Hopkins University; and E. Y. Wolford, Chemical Div., Koppers Co., Inc., who also served as secretary.

Arrangements for the meeting were made by the Swedish Standards Association (S.I.S.), Swedish Electrotechnical Commission (S.E.K.), and Swedish Plastics Federation (S.P.F.) A reception for the delegates and their accompanying ladies (100% for the U.S. delegation) was held by the S.I.S. on August 10. The S.P.F. was host at a dinner and dance on August 13.

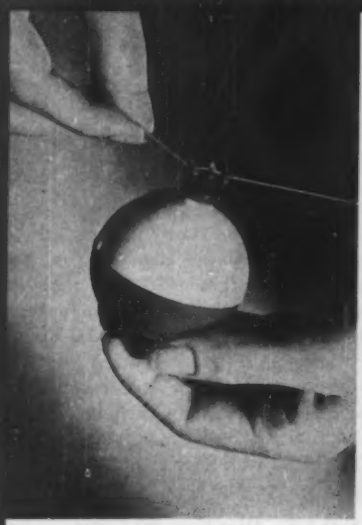
I.U.P.A.C. Plastics Division

The Division of Plastics and High Polymers of the International Union of Pure and Applied Chemistry (I.U.P.A.C.) met in Stockholm during the International Congress held July 29 to August 7. This division

(*Continued on p. 216*)

Twelve countries were represented at the Stockholm meeting of I.S.O./T.C. 61

The Swedish Plastics Federation entertained the delegates attending the I.S.O. meeting



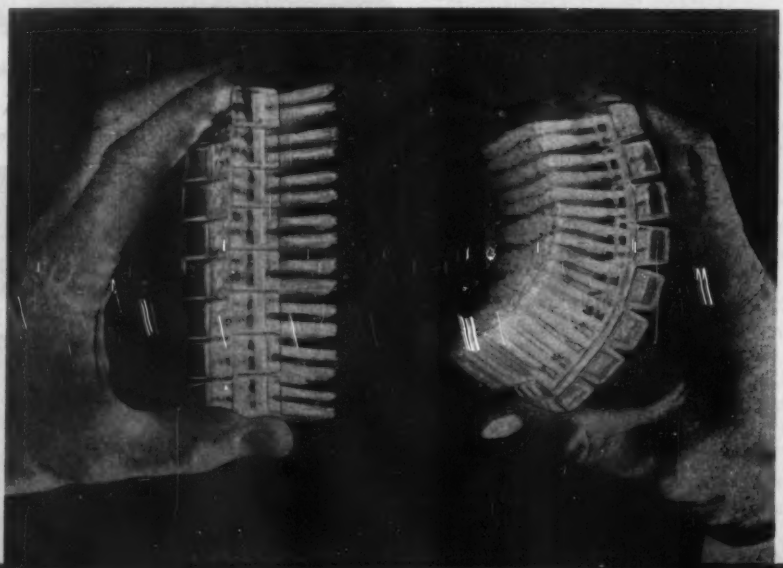
Mechanism for locking fishing float automatically after casting is molded of Tenite I cellulose acetate. Outer shell is Tenite II cellulose acetate butyrate. Molded by Detroit Plastic Pdts. Co., 21614 Groesbeck Hwy. for Coughlin Specialties Co., 579 Drexel Ave., both of Detroit, Mich.

Home manicuring can be done as easily in a moving car as on the lap at home or on a desk using this holder molded of styrene. It features a raised projection in the center of the base on which one finger at a time can rest to avoid touching and smearing. The projection can also be used as a handle for moving the kit. Built-in compartments hold accessories. Made by M & M Plastic Co., 700 S. Palm Ave., Alhambra, Calif. for Cal-Del-Mfg. Co., P. O. Box 15688, Crenshaw Station, Los Angeles 8, Calif.

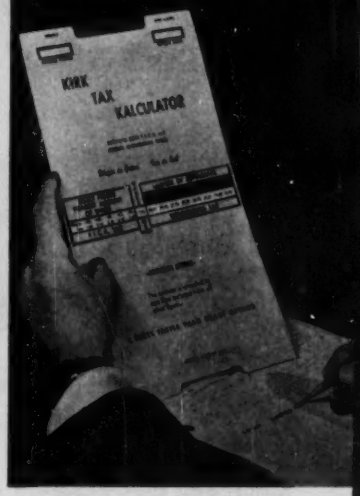
PLASTICS

Boon to the busy housewife is the flexible four-piece graduated polyethylene canister set guaranteed by the manufacturer not to break. The resilient material will not dent or scratch table surfaces and is impervious to staining. Sets are available in red, yellow, coral, chartreuse, and apple green—with white lids. Molded by Plas-Tex Corp., 2525 Military Ave., Los Angeles 64, Calif.

Injection molded Lucite sections held together with molded nylon rods form the novel backs of this nylon bristled military brush set. The rods run the length of the brushes on both sides and provide flexibility to follow the contours of the scalp. Available in two colors and styles with matching comb. Made by Tek-Hughes Div., Johnson & Johnson, New Brunswick, N. J.



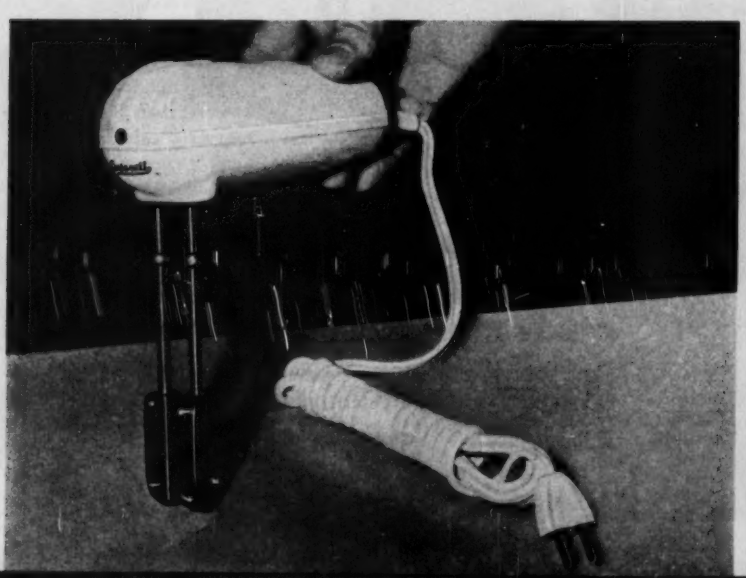
Ideal for serving small parties is a space-saving swivel buffet tray molded of Dow styrene. When open, the tray presents seven separate wells that can be used to hold different foods. Handles are removable so the unit can be disassembled. The four individual serving trays may be used separately. Colors include forest green and chartreuse; pearl gray and forest green; pearl gray and burgundy. Molded by Loma Plastics, Inc., 3000 W. Pafford St., Fort Worth, Texas.



Sheets of 10-gage Celanese acetate are formed into a protective cover for 8- by 12-in. calculator which allows payroll tax deductions to be made rapidly. Three separate payroll period inserts are available. Made by Kirk Plastic Co., 170 E. Jefferson Blvd., Los Angeles, Calif.

PRODUCTS

Midget portable food mixer of durable white Plaskon melamine weighs only 31 ounces. The molded housing, with its excellent insulating properties, will withstand high temperatures and protect the hand against excessive motor heat. Made by General Die Mold Co., 548 N. Sacramento Blvd., Chicago, Ill., for John Oster Mfg. Co., Racine, Wis.



Better performance and longer life of this eraser is attributed to the use of Vinylite resin as a binder to replace rubber. Resistance of the vinyl based eraser to crumbling enables it to outlast conventional erasers of its type. It also reduces amount of crumbs on working surface. Produced by Richard Best Pencil Co., Inc., 211 Mountain Ave., Springfield, N. J.

DIG

that crazy die...

The men of Midland are always hep, always on the prowl for new ways to do old stuff faster, like molds and dies. Now we've come up with this new KFI die sinker, which, in the hands of a Midland pilot, performs intricate milling

operations on steeply inclined surfaces in close quarters. We can duplicate 1 to 1, or reduce, or enlarge, in 2 or 3 dimensions, better and faster than it was done before. You get excellent surface finish on concave, convex, cylindrical, spherical or conical parts, with practically no hand finishing required. This means less tooling delay, a true initial die, faster production

...te

3D

happens at Midland every day

our new
3 Dimensional pantograph engraver
goes up and down, and
round and round,
all at once...

MIDLAND

DIE & ENGRAVING COMPANY

Plastic Molds • Die Cast Molds • Engraved Dies • Steel Stamps
Pantograph and Hydrotel Milling • Hobbed Cavities

1800 Berenice Ave. **Chicago 13, Illinois**

D&E

PLASTICS ENGINEERING*

F. B. Stanley, Engineering Editor

Restricted Gating

Uniform high gloss and freedom from flow lines are obtained in injection molded vinyl elastomer parts by the application of proved principles

by R. Bostwick† and C. A. Joslin†

ONE of the basic requirements in the molding of vinyl elastomers is to deliver sufficiently hot and fluid material to the mold cavity to produce molded pieces of good appearance. Uniform high gloss and freedom from flow lines are the major appearance factors. The thermal sensitivity of Vinylite plastic compounds, and particularly the time-temperature sensitivity, imposes a limit on the injection cylinder temperatures which can be used. This limitation, together with heat loss from the material during travel through sprue and runners, has been a serious problem in the injection molding of vinyl elastomers. The use of restricted or pin-point gating to provide "flash heat" at the last instant before filling the cavity offered hope as a means of overcoming this problem.

General Considerations

A significant advance in the art of injection molding vinyl elastomers has been made with the proper application of restricted gating. This technique has been applied successfully to a laboratory knob mold, a color checker production mold at the Bound Brook plant, and a commercial four-cavity vacuum cleaner handle mold at George S. Scott Mfg. Co., Wallingford, Conn. The improvement is primarily in molded appearance, and principally in gloss.

Recommendations are given for a gating design of general utility for vinyl elastomers. The basic feature of this design is the use of a 0.015-by $\frac{1}{16}$-in. restriction close to the cavity entrance.

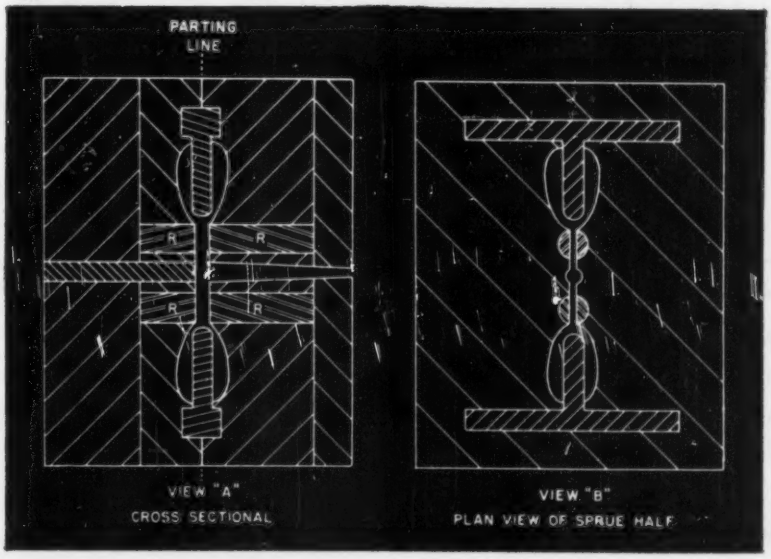
The early injection molding of Vinylite elastomeric compounds was seriously limited by the high viscosity of the material at allowable operating temperatures. This was particularly true of the higher durometer compounds. In considering the heating of vinyl elastomers (or any other thermoplastics) in injection molding, the time of travel through the cylinder, the cylinder temperature, and the material temperature at all points in the cylinder and nozzle must be taken into account.

In addition, it must be recognized that there is a loss of heat from the material during passage through the normally cold sprue and runners.

These factors determine material temperature and fluidity at the time of delivery to the mold cavity which, in turn, is a major factor in determining the appearance of the molded piece. For best appearance the material should be as hot and as fluid as possible when it enters the mold cavity. Because of the thermal sensitivity of these vinyl compounds, however, the technique of simply increasing cylinder temperature, used so successfully with some other thermoplastics, is not applicable.

At least two approaches to the problem of increasing temperature

Fig. 1—Two-cavity large-gated knob mold with removable core pieces in position



* Reg. U. S. Pat. Off.

† Development Laboratories, Bakelite Co., Div. of Union Carbide and Carbon Corp.

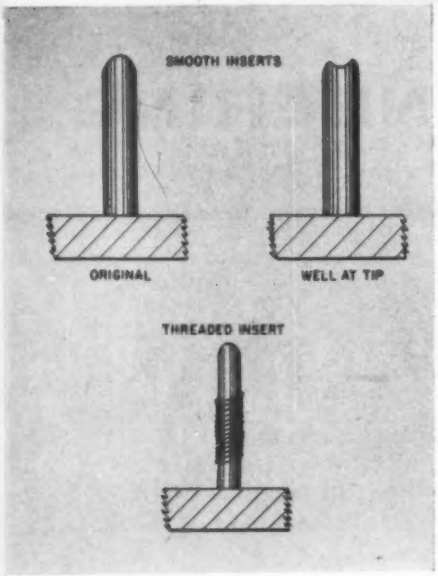


Fig. 2—Three types of inserts used in restricted gating studies

and fluidity—formulation and molding technique—are available. The first approach has been fruitful and helpful in the acceptance of Vinylite elastomers as injection molding materials. The concern in this report, however, is in the second approach, which is primarily mechanical.

Temperature Limits

The present stabilization art imposes a material temperature limit of about 350° F. at the nozzle for Vinylite elastomeric compounds. Travel through sprue and runners has a cooling effect so that material delivered to the cavity is somewhat below the temperature at the nozzle. For some shapes, and particularly with 80 and 90 durometer "A" compounds, this is not sufficient to produce acceptable pieces of uniformly high gloss. In such cases noticeable improvement can often be made by increasing cylinder temperature but this is only of academic interest since material discoloration occurs after a short time of operation.

Until recently, it was customary to employ large gates, ⅛ in. diameter and more, in mold design. The gates were often the same size as the runner. Such gates, naturally, contributed nothing toward increasing material temperature. Experimentation over the past three years has shown that the use of a restriction below 0.025 in. in diameter at or near the cavity entrance has a great effect on improving gloss. A reasonable explanation is that frictional heating occurs with a nearly instantaneous temperature rise which is sufficient to give the desired high gloss but is too short in time to cause discoloration or decomposition.

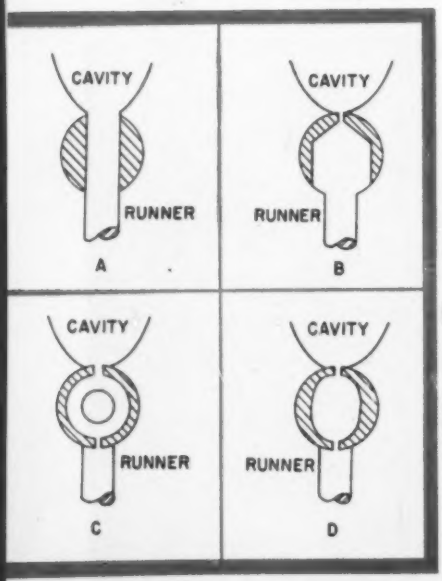
Heating of the material can be looked upon as a two-step process. The cylinder constitutes the first step and here the material should be heated to a level where the possibility of discoloration is remote but where fluidity is sufficient for machine operation. The second step is at the restriction where a final "flash" heat is obtained frictionally.

Elementary considerations of good mold design used in the work described below were:

1) Use of full round runners.

2) Blunting (no streamlining) of the runner before the restriction to permit only the hot center to flow through the restriction and not the chilled layer adjacent to the side of the runner.

Fig. 3—Of four gating systems tried, C and D produced the best results



Laboratory Knob Mold

The first laboratory study at Bound Brook in applying restricted gating to a mold was carried on during the latter part of 1949. A two-cavity knob mold which had been employed for several years in laboratory compound development work was used. A sketch of this mold with the large gate in existence at that time and with core pieces in position is shown in Fig. 1. View "A" is a cross-sectional view of the mold, while "B" is a plan view of the sprue half. During molding, the knobs and core pieces are removed from the mold at the end of the cycle; the knobs are removed from the core pieces; and then the core pieces are inserted in the mold for the next cycle. The knob is a hollow piece approximately two inches long with an I.D. of ½ in. and an O.D. of 1 in. at the widest point. Weight is approximately 20 g. or about ⅔ ounce. Wall thickness is dependent upon the dimensions of the core piece. At the start of this work the smooth insert ("original") and the threaded insert shown in Fig. 2 were in use.

The mold was adaptable to a study of the effect of gating since both gates were in removable pins ("R" in View A, Fig. 1) and gate changes were made by making new sets of pins. These pins were also runner stops; by rotating the pins the cavities could be closed off independently.

The runner stop pins made were based on the four different gating systems shown in Fig. 3 (mold surface views). System A was the type used at the beginning of this program. Runner and cavity entrance were both approximately ¼ in. full round. This system had never given pieces of uniformly high gloss except with the soft 60 durometer compounds, and there only with the smooth insert. Normally, molded pieces had dull areas on the surface.

System B was tried next. This consisted of a ⅜ in. full round runner tapering sharply over a $\frac{3}{32}$-in. distance to a 0.015 in. full round cavity entrance $\frac{1}{16}$ in. long. With the smooth insert, this system produced pieces of good overall gloss but with severe "splash" marks on the surface. This particular insert gave a space of about 0.100 in. in the mold cavity between the tip of the insert and the gate, and the effect of reducing this distance was investigated. Use of a longer core piece, which brought the tip of the insert to within 0.020 in. of the gate, reduced the splash marks considerably. However, perfect pieces over the normal hardness range of 50 to 90 were not obtained with this system of gating, even though gate dimensions were varied. Results with the threaded insert were somewhat poorer.

System C was more successful. Here the restriction was moved back from the cavity, a pin was introduced in front of the restriction to produce annular flow, and a large entrance was used directly into the cavity. Satisfactory dimensions were 0.15 in. full round and $\frac{1}{16}$ in. long for the restriction, a $\frac{3}{16}$ in. round pin, and a $\frac{1}{8}$ in. round cavity entrance. The grooves around the pin were $\frac{1}{8}$ in. full round runners. Pieces of good appearance and gloss were produced with this gate system from both smooth and threaded inserts, with the former somewhat better. The distance between the tip of the core piece and the gate was not critical.

System D was also successful and even better than C. Here again the restriction was moved back from the cavity, and a well was used between the restriction and the actual cavity entrance. The restriction was 0.020 in. full round and $\frac{1}{16}$ in. long, with the well 0.200 in. full round. The entrance into the cavity was 0.040 in. full round and $\frac{1}{16}$ in. long. Here again the distance between the tip of the core piece and the gate was not critical.

An additional modification which proved helpful was to put a small depression or well 0.050 in. deep at the tip of the insert directly opposite the gate. This is shown in Fig. 2 for the smooth insert. Presumably this assisted in "balling up" the first material issuing from the gate and prevented the presence of threads of material which would form weld lines.

General Observations

Some general observations made during the course of this work are listed below.

1) Knobs of high gloss could be molded at much lower cylinder temperatures with the restricted gating systems than was possible with the large gate. For example, VG-9960 (a standard Vinylite 60 durometer molding compound) produced a high gloss at 260° F. cylinder temperature with restricted gating while 360° F. was required to produce a similar gloss with the large gate. In the latter case, discoloration appeared after several minutes molding at higher temperature.

2) The restricted gating systems required higher injection pressures than the large gate. For example, at the same cylinder temperature, VG-9980 (a standard Vinylite 80 durometer molding compound) required 15,000 p.s.i. in the restricted gating systems and 7000 p.s.i. in the large gate.

3) The tip of the core piece, which is directly opposite the gate, became much hotter with the restricted gating systems than with the large gate. This would support the theory that intense frictional heat is generated in the restriction. This was particularly noticeable with the longer core piece which came within 0.020 in. of the gate.

The experience gained with the laboratory knob mold was next applied to an injection molding problem within the Bound Brook plant, concerning the production of color checkers for sales purposes. This was a particularly difficult job because one requirement was that the color checkers be perfect on all surfaces. Commercially there is often some place at which blemishes can be hidden where they are not visible to the user. A six-cavity mold with the conventional large-size gating had been built and after some initial difficulties was being operated satisfactorily for production of polystyrene and polyethylene color

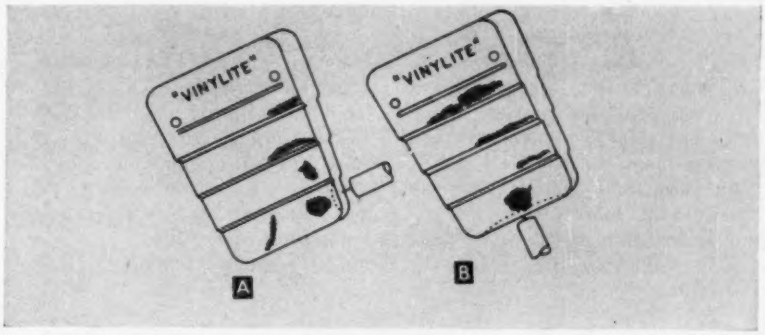


Fig. 4—Restricted gating directly into thin section caused weld lines and smear marks

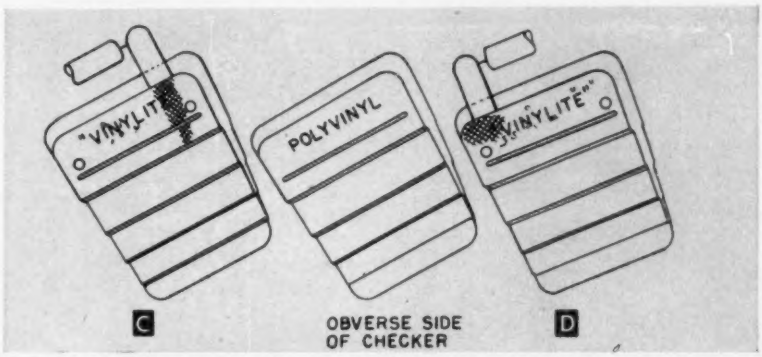


Fig. 5—Restriction in runner, large opening into cavity, resulted in poorly molded letters

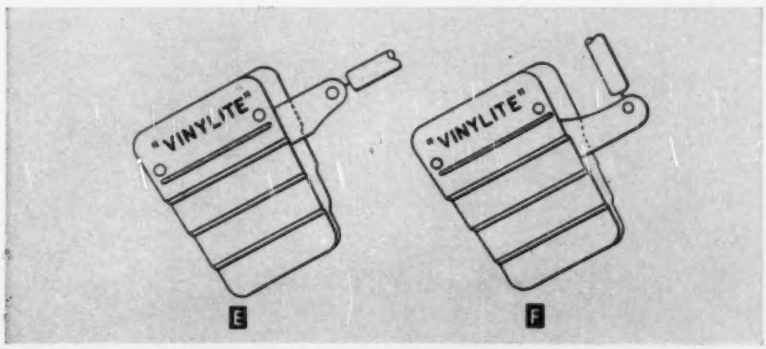


Fig. 6—Perfect pieces were made by entering thick section from side with gating shown

checkers. However, satisfactory color checkers could not be molded from Vinylite elastomeric compounds. The difficulty was primarily in obtaining a uniformly high gloss over the piece.

Color Checkers

A two-cavity color checker mold was designed and built to explore the application of restricted gating to this problem. The mold had been designed before the work on the laboratory knob mold was complete and the cavities were gated directly into the thin section with a restricted gate as shown in Fig. 4 (A). The color checker itself contains four steps of different thicknesses — 0.050, 0.100, 0.150 and 0.200 inch. The length is $2\frac{7}{16}$ in. with the width tapering from $1\frac{3}{4}$ in. at the thick end to $1\frac{1}{2}$ in. at the thin end. The mold parting line is straight down the middle of the edge of the piece. The tapered sections between the steps are at a 45° angle.

The designated gate (A, Fig. 4) was 0.015 in. in diameter and $\frac{1}{16}$ in. long and entered the cavity from a ¼ in. full round runner into the side of the thinnest section. The difficulties encountered with this system are shown in Fig. 4. For one thing, the injected plastic flowed oniy ½ to ⅔ of the way across the cavity from the gate and then filled out the thicker sections, circling around to the corner opposite the gate and filling that last. This caused a prominent weld line as shown in Fig. 4 (A). There were also smear marks and a slight distortion around the gate. Weld lines at the steps indicated that the plastic had jumped over and then folded back to fill the void. The over-all gloss was good, showing that the restricted gate was doing its job of heating the material sufficiently.

These defects could not be remedied by changing molding conditions or gate size, and a similar gate was next tried at another point on the thin section as shown in B, Fig. 4. This cured the prominent weld line in the thin section, but the weld lines due to jumping over at the steps were somewhat worse and distortion or pushing in at the gate was definitely worse.

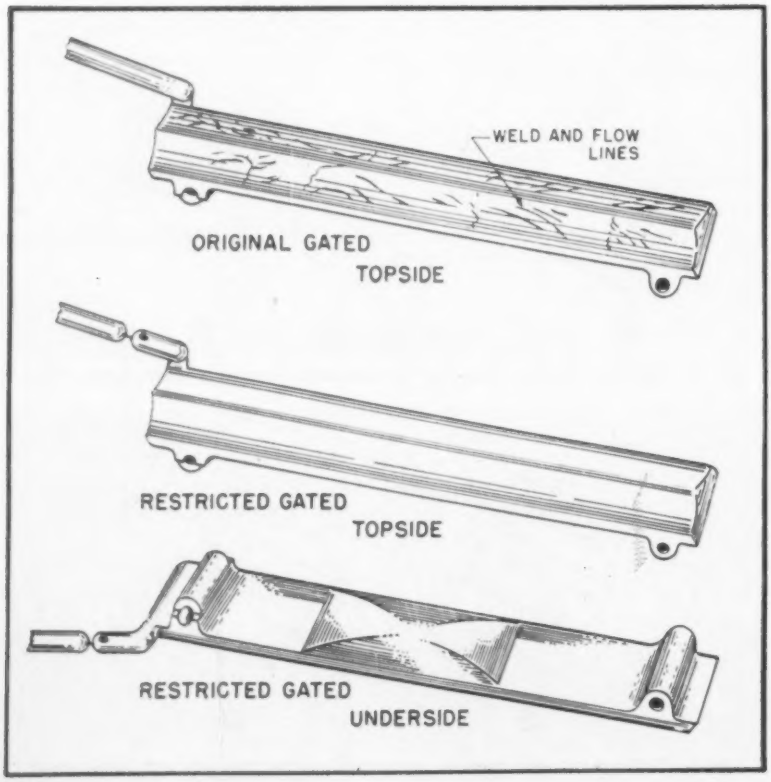
The problem of jumping over at the steps seemed inherent in entering the cavity from the thin end and the next step was to try gating from the thick end. Preliminary trials with a restricted gate directly into the cavity again gave an over-all high gloss and did not show the jumping over at the steps, but did give numerous weld lines and a "ball of yarn" effect. Apparently the first thread of material issuing from the restricted gate into the large open cavity suffers a loss in pressure and forms a loosely knit structure which never fuses completely. This "ball of yarn" is readily visible in a short shot. Therefore the technique used in the knob mold of moving the restriction back into the runner and entering the cavity with a large opening was tried. The first two systems used are shown in Fig. 5.

Here again the restriction was 0.015 by $\frac{1}{16}$ in. and placed ¾ in. from the cavity entrance to coincide with a right angle bend in the runner. The runner was ¼ in. full round as before and the cavity entrance was rectangular — 0.200 by 0.250 inch. Gating "C" shown in Fig. 5 was tried first. This was immediately successful in giving good pieces except for difficulties caused by the lettering, which was recessed in the mold cavity on both sides. The side which gave the most trouble is shown in Fig. 5. The "E" of Vinylite directly in front of the gate caused a smeared area as shown. There was no letter in front of the gate on the reverse side (POLYVINYL) because of the smaller size lettering employed there, and correspondingly, no smear mark. There were small curlicues around the letters on both sides which varied in position and severity from piece to piece. The "E" was the cause of the smearing and this was conclusively shown by the fact that when the "E" was soldered smooth, the smearing disappeared. Of course, this meant the "E" was not present on the molded piece.

Gating at the other end of the thick section was tried as shown in D of Fig. 5 in the hope that the "V" might be less troublesome. The smearing was reduced, but was still present. Variations in gate size and location along this end of the piece did not completely remove the smearing and curlicues around the letters.

The next step taken was to enter

Fig. 7—Restricted gating (center and bottom drawings) improved quality of molded pieces



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the thick section of the piece from the side as shown in Fig. 6. Again the restriction was 0.015 by 1/16 in. and located 3/4 in. back in the runner from the cavity. This immediately showed a lack of the imperfections around the letters associated with the previous gates. After a number of trials, the two gates shown in Fig. 6 were worked out dimensionally to give well-nigh perfect pieces. Both cavity entrances are 1/2 in. wide and approximately the thickness of the cavity at that point. In both cases, it was necessary to overlap into the adjacent section to eliminate a small smear at that point. A 1/8-in. pin located 0.100 in. from the restriction helped in both cases in eliminating the last traces of weld lines. This had been tried with the gates in Fig. 5 without success. A final point is that a shiny spot appeared on the piece on one side or the other when either cavity entrance in Fig. 6 was made flush with the cavity on both sides. When the entrance was stepped down 0.010 to 0.012 in. on one side (dotted lines in Fig. 6) this disappeared. However when the entrance was stepped down on both sides, flow marks appeared.

The work was concluded at this point since the object of producing acceptable pieces had been accomplished. This study showed, as did the work with the knob mold, that the use of a 0.015- by 1/16-in. restriction at the gate or in the runner near the gate develops high gloss with vinyl elastomeric compounds at molding temperatures well below the danger zone for this material. However, as in all mold design work, the production of unblemished pieces is dependent on gate location and dimensions.

Field Application

An opportunity to apply laboratory experience on restricted gating to a commercial molding job was offered when George S. Scott Mfg. Co., undertook the production of vacuum cleaner body handles for the Electrolux Corp. Sketches of the part are shown in Fig. 7. The handle is approximately 8 1/2 in. long by 1 1/8 in. wide. Thickness varies from approximately 5/32 to 7/16 inch. Weight is 1 3/4 oz. in Vinylite elastomer of 1.36 specific gravity.

A four-cavity mold had been designed and built but the molder was not able to produce satisfactory pieces. A 90 durometer compound had been specified and QG-9590 Blue 139 (a standard Vinylite molding compound) was being used. Normal mold design practice had been followed and each cavity was supplied by a 1/4 in. full round runner and a good-sized 1/8- by 1/4-in. gate at one corner as shown in Fig. 7. The handles molded in this mold were low in gloss with numerous surface imperfections. Use of the highest possible cylinder temperatures without material decomposition gave unsatisfactory pieces.

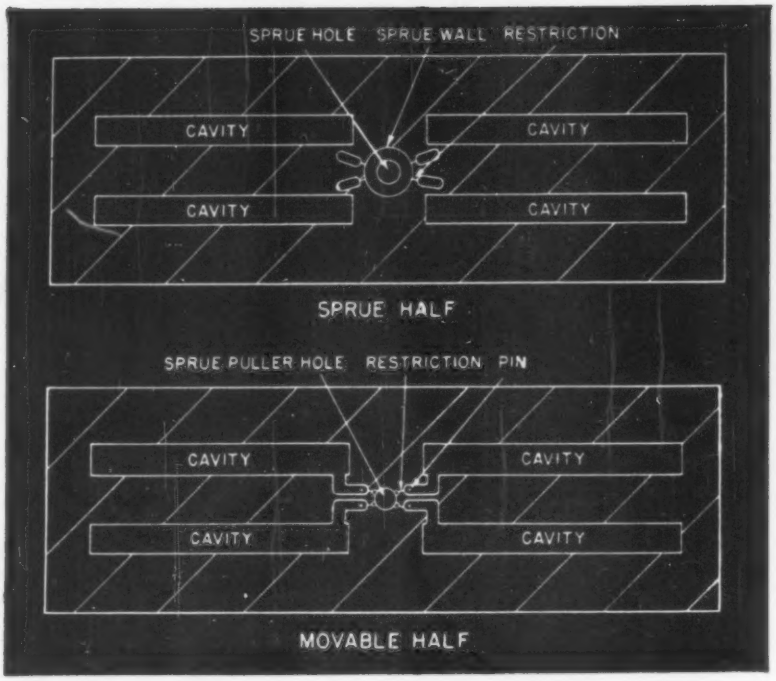


Fig. 8—Diagram of gating system used in molding handle shown in lower part of Fig. 7

A restricted gating system similar to the one successfully used in the color checker mold was recommended and its trial immediately gave beneficial results. The improvement in appearance was very striking and the molder since then has been molding this item successfully on a production basis. The molded handles are of very high gloss and free of surface blemishes except for a small dull spot near the gate which is buffed after the piece is removed from the mold.

The gating system used is shown in the sketch of the four-cavity mold in Fig. 8. The cavity entrances and runner positions are essentially unchanged from the original design. The restriction and pin placed in each runner are responsible for the markedly improved appearance of the piece. During the working out of this final system, the restriction was first 0.015 in. in diameter, then 0.010 in., and finally merely a surface scratch in the mold. The length of the restriction was kept constant at 1/16 inch. Each restriction is located approximately 3/16 in. from the sprue and 5/8 in. from the cavity entrance. Each pin is 1/8 in. in diameter, extending from one side to the other of the 1/4 in. full round runner and located 0.100 in. from the restriction.

The sprue is 1 3/8 in. long, tapering from 11/32 in. at the nozzle end to 7/16 in. at the mold end. In line with good mold design practice, only full round runners are used. Since the cavity in the sprue half of the mold is shallow, the runner on that side of the mold stops short of the gate. In addition to the normal cold slug, the molder cut a well 5/32 in. deep and 1 in. O.D. at the mold end of the sprue, which was helpful in obtaining good pieces.

In line with the experience gained from the color checker mold, the large gate into the cavity is flush with the piece on one side and

(*Continued on p. 217*)

Mold Temperature Control

by C. H. Whitlock*

THERE has been an increasing interest in mold temperature control in recent years. Most injection molders have practiced mold temperature control in some form or other since the advent of injection molding of thermoplastic materials. This practice was brought about by the necessity of removing heat from the mold as cycles were speeded up and larger capacity machines came into use.

Early injection molds were not channeled for circulation of coolant but, as the need for temperature control became more apparent, copper tubes were wrapped around molds and cavities to take away the heat from the material in the mold. As molding techniques developed, channeled molds were made and the first stage of mold temperature control was practiced by allowing a restricted amount of water to pass through the channel in an attempt to maintain a temperature that would produce a satisfactory part.

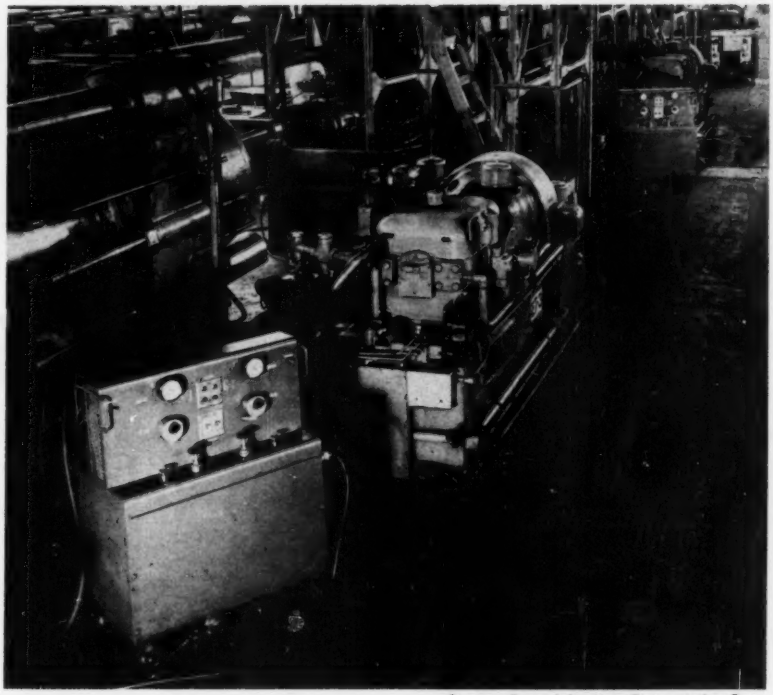
Even though injection molding has made tremendous advances both in machine capacity and in techniques during the past 15 years, a great majority of injection mold temperatures today are still controlled by simply adjusting a valve to allow the flow of a certain amount of cooling water.

Control Development

A few molders have gone a bit further and have developed circulators which, in general, consist of a tank with a circulating pump and thermostatically controlled heaters. With such a set-up more accurate mold temperatures can be maintained. In addition, several manufacturers have made up circulating units, first with heaters only, and, in the past few years, with equipment for both heating and cooling.

It now has been proved with authority that best results can be obtained in injection molding if mold temperatures are accurately controlled. There are no exceptions.

In the preparation of this article, approximately 100 injection molding jobs were studied to obtain data on the effectiveness of mold temperature control.



Courtesy General American Transportation Corp.

Growing awareness of importance of mold temperature control is emphasized by this view of a line of three 300-oz. injection machines, all equipped with control units

First, the requirements of a satisfactory mold temperature controller must be established. We do not feel that a device for heating only, with no provisions for cooling, is adequate. It is true that some jobs require heat input only, but the average requirement of mold temperature control falls between 120 and 140° F. This makes it necessary to provide a cooling feature, since the heat input from the plastics material to the mold will, in most instances, run the mold temperature above 140° F.

Further, there should be two separate heating and cooling media to permit two different temperatures to be controlled. These temperatures do not necessarily have to be on the two halves of the mold. Many jobs have like temperatures for the mold halves and a different temperature for a stripper plate or core plug. The mold temperature controller should have adequate heat input for rapid production. It should have a high velocity pump on each side of the unit to permit fast flow of the liquid in order to maintain close limits of temperature. These are the main features. There are many variations incorporated in the mold temperature controllers now on the market.

One important variation which should be mentioned here is the closed system, which allows the use of a liquid which can be heated above the temperature of water and cooled by means of some form of heat exchanger.

It has been found that temperatures above 225° F. (the safe high limit for most water units) are necessary on some jobs but these are few and far between. It can often

(*Continued on p. 134*)

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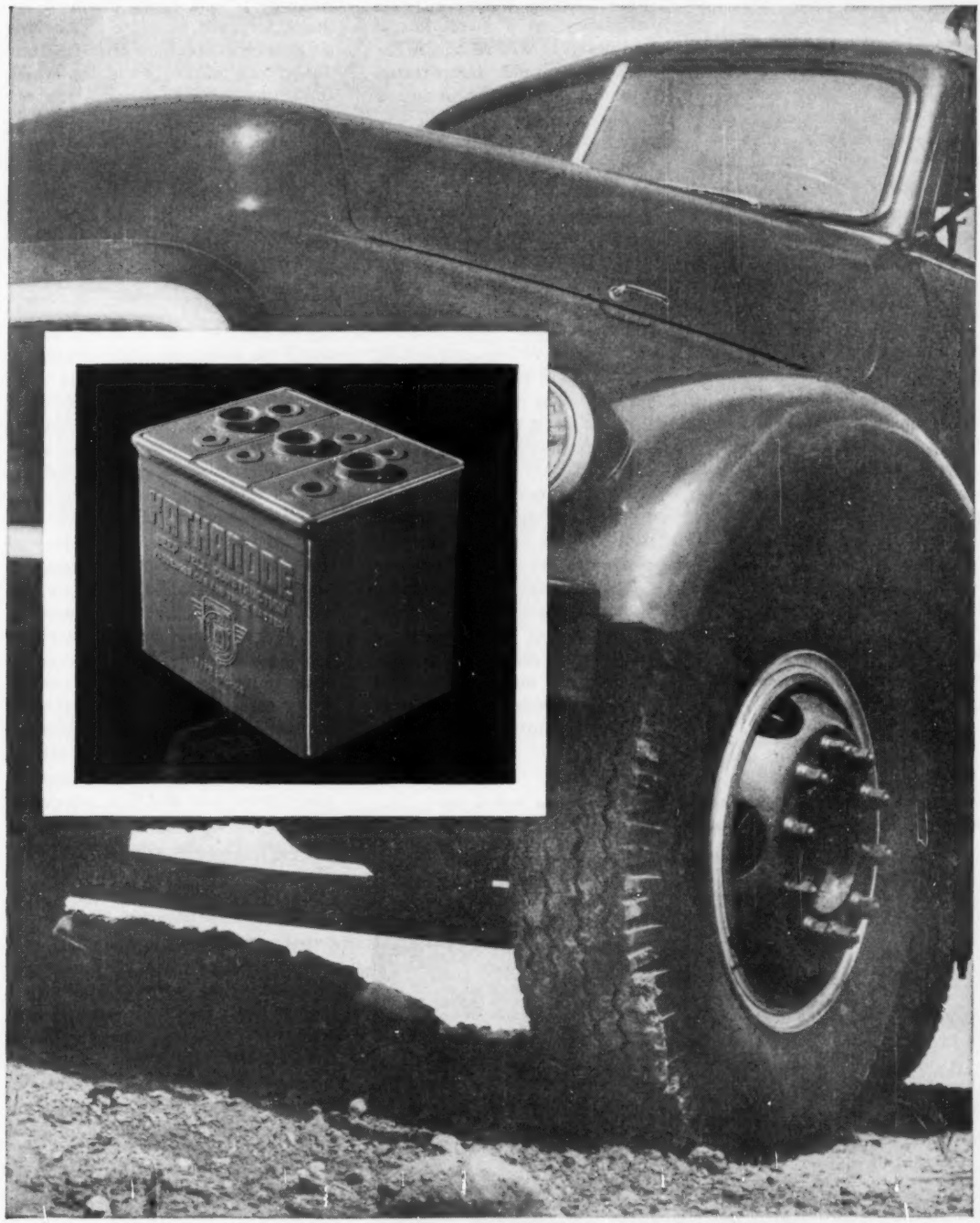

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be established that the only reason why these high temperatures are needed is because of improper mold design with inadequate channels requiring a higher temperature to heat the mold. Of all tests made there were no instances in the molding of the commonly used thermoplastic materials, including nylon, where the mold temperatures at the cavity or cure plug surfaces were above 205° F.

In one case studied, the heating medium was being run at 250° F. and the mold was at 148° F. at the edge of the cavity furthest from the nearest channel. With proper mold design, mold temperature could have been maintained with the mold temperature controller set at 150° F., or slightly higher.

It must be understood here that the majority of molds which can not be controlled to a satisfactory degree of accuracy and in which inaccuracies can be traced to improper mold design, are usually molds which have been in use for many years. What is now termed improper design does not necessarily mean that the design was initially wrong.

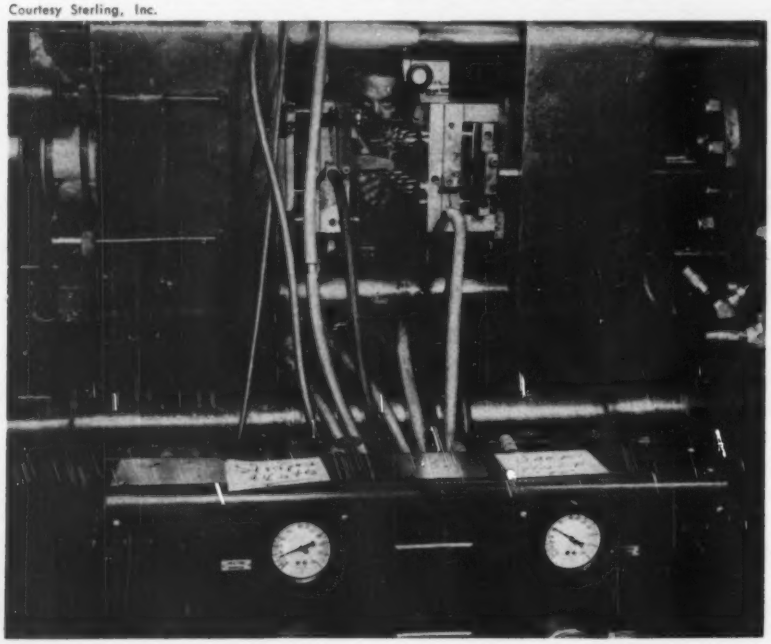
Importance of Design

It is obvious that mold design has become progressively more important with an increased understanding of temperature control. It is easy to set down rules for proper design for channeling but in practice the mold designer has many problems to surmount before attaining maximum efficiency on a given job. If the mold designer will recognize the desirability of mold temperature control and approach the design of cavity, runner, and gate with this in mind, a design can be achieved in which the channeling will give the best control possible without too many compromises because of knock-out pins, core pins, guide pins, etc. A careful study of the problem will usually bring at least a partial solution to any apparently impossible situation.

Much has been written concerning the effect of mold temperature control on injection moldings. Mold temperatures have been established for various materials which will give the best molding results. Today, however, we are asking a great deal more of mold temperature control. Most applications call for exacting control even to the point where two molds for the same part, running in two similar presses, could require different treatment of temperature control to obtain maximum results. For example, one molder found that the degree of polish in a cavity changed temperature requirements.

Mold temperatures are so critical in the production of acrylic lenses with a low percentage of rejects that an efficient mold temperature control system is essential

Courtesy Sterling, Inc.



It has been widely but erroneously accepted that mold temperature control is for large molds only. This is a mistake. If the molder would approach every job with the thought that it requires mold temperature control, he will have eliminated one of the variables which are always present in every job, big or small.

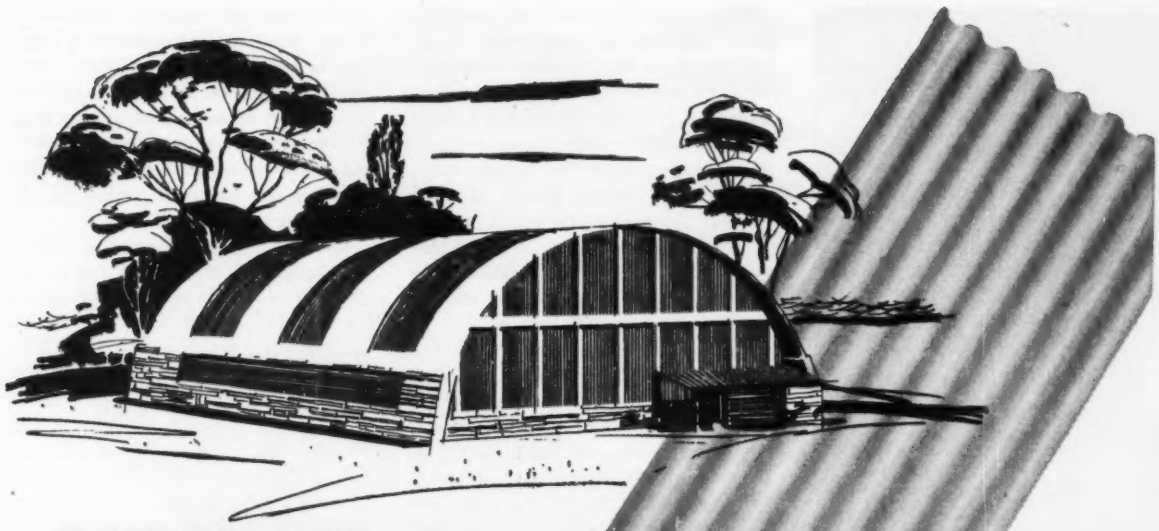
To attain maximum physical characteristics of the molded part, careful temperature control has to be exercised all the way from the hopper through to ejection of the part from the mold.

Control Stages

There are at least four and sometimes as many as eight stages of temperature control during this overall operation. Three of these stages can be in the mold, not including the hot runner type of mold. Thus, one third to one half of the control may be centered in the mold itself. Expensive instruments are used to control the temperature of the material through the injection machine to the mold. Yet a molder will often insist that the balance of the operation can be controlled by a one dollar valve which is cracked open to adjust the flow of cooling water through the mold to get some semblance of mold temperature control. It would be just as ridiculous to install a good mold temperature control unit and then attempt to control the temperature of the material through the injection cylinder by a series of manual rheostats to adjust the electric current in the heater bands without the use of temperature indicators in any part of the system.

Many believe that mold temperatures must be kept low to gain high cycle speeds. They overlook the fact that higher mold temperatures allow for reduced material temperatures with lower injection pressures. The net result is to speed up the cycle.

In order to visualize this last statement, let us start with the temperature of the molded part as it is ejected from the mold. The requirement here is to have the ejected part hold to form without distorting. Let us assume that the part as it is ejected has a mean temperature of 180° F. The plastics material as it left the nozzle had to be at a flowing temperature of, for



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Courtesy Sterling, Inc.
Mold temperature control resulted in fewer rejects of refrigerator liner

example, 340° F. We can therefore say that the material required a temperature of somewhere between 180 and 340° F. to allow the cavity to be filled. We also know that the instant the material hits the cavity surfaces, it starts to cool. It follows that the colder the cavity surfaces, the faster the material is chilled. To fill a cold cavity we either have to have the material at a higher temperature or increase our pressure or both. It can then be assumed that the nearer the mold temperature approaches the 180° F. ejection temperature, the lower can be the material temperature in the injection cylinder to effectively fill the cavity. As we lower the amount of heat which has to be removed from the injected material before opening the mold, we speed up the cycle.

It can readily be seen from this that the larger the cavity, or the larger the multi-cavity mold, the wider will be the spread between the material temperature as it leaves the nozzle and the temperature of the part on ejection. This is because of the greater distance the material has to travel to complete the filling of the mold cavity or cavities. It may be that this perfectly valid reasoning has led to the generalized but invalid assumption that only large molds require mold temperature control to obtain satisfactory parts economically.

More than 50% of the molding jobs observed in this study could be placed in the "small" classification; and almost every one was being run with a "cracking of the valve" type of mold temperature control. A recording of water supply temperatures in these plants showed that it fluctuated as much as 30° F. throughout the day. Water pressures also varied an unbelievable amount. A mold would be started in the morning with one setting of the "cracking of the valve" control. Then the setting would be changed frequently throughout the day to maintain some semblance of control. The most obvious waste occurred because the operator had no way of determining changes taking place in mold temperature until rejects resulted.

Here lies the answer to a large share of short shots, distorted pieces, sink marks, and other defects. Such rejects vary in percentage from plant to plant and from job to job, but they are always reasons for concern—and cause for investigation—by management.

Materials Makers Concur

Most of the suppliers of thermoplastics materials have gone on record as advocating the need for mold temperature control. The Dow Chemical Co. for example, in the bulletin "The Technology of Injection Molding I—Fundamental Considerations," states in part: "It is not adequate mold temperature control to attach the cooling channels of the mold to a manually adjusted trickle of water from a city water main, artesian well, or refrigerating system. A small flow of relatively cold water causes a considerable temperature variation throughout the length of the cooling channels. Therefore, uniformity of temperature over the surface of the mold is not possible. The best designed mold in the world cannot overcome this difficulty. Good mold temperature control comes from having a large amount of heat exchange fluid at a temperature within 5 to 10° F. of the desired mold temperature. Mold temperature control equipment is available to provide heat exchange fluid which will produce this result. A considerable capital equipment cost is involved, but such investments have been found to be among the most rapidly amortized items of molding equipment. When good mold temperature control is added to some of the newer mold design techniques, increased production of salable moldings may be very great. In certain cases, savings have been sufficient to amortize the investment in a period of six weeks or less."

One of the accompanying photographs shows a refrigerator inner door liner which is being produced by General Machine & Tool Works, Inc., Walled Lake, Mich., in a 300-oz. machine. George J. Kovacs, president of that company, states that mold temperature control has enabled him to get into production faster and to maintain uniform temperature on his molds, with the result that greater production has been achieved with fewer rejects. Production increase is reported to be 10 to 25 percent.

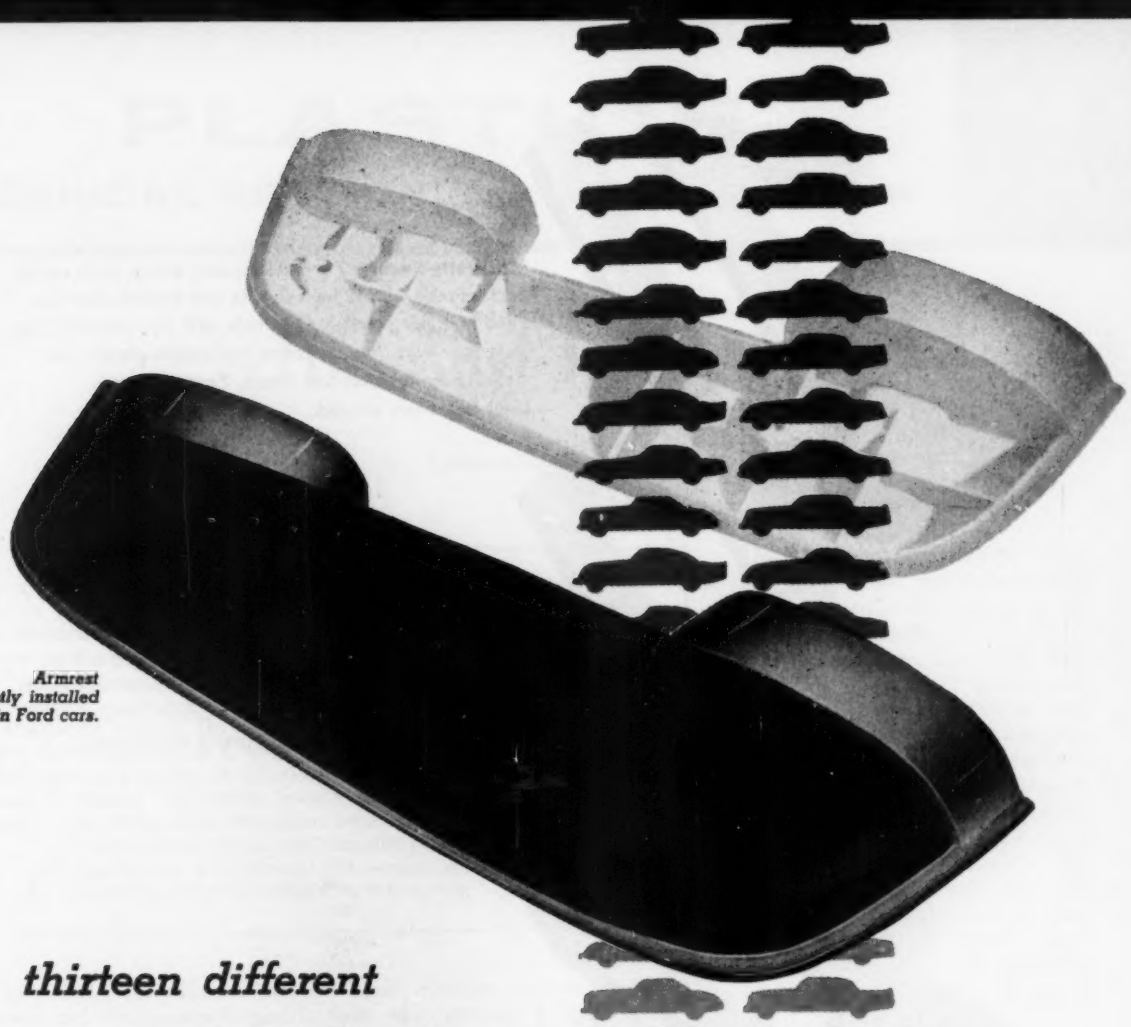
Among those who have done much to promote the use of mold temperature control is Kenneth Rouzer, manager of the Plastics Div., General American Transportation Corp. Mr. Rouzer has equipped every one of his 32 injection molding machines with mold temperature control.

On one occasion he even found it necessary to use two units on one mold because four separate temperatures had to be used to obtain satisfactory parts.

Another advantage of mold temperature control reported by Mr. Rouzer is the control of shrinkage and strain in molded parts, large and small—especially those which are later to be decorated. This work always has been tricky; now rejects have been reduced considerably because of the close fits obtainable with the painting masks.

In another case study, mold temperature control reduced the warpage of wall tile to within acceptable limits; the same technique has proved to be invaluable for the elimination of strain.

The foregoing report is made in an attempt to convey the results of observations of a wide range of operations, both with and without mold temperature control. Much more evidence could be produced in favor of such control. It is hoped, however, that sufficient information has been given to excite the interest of those molders who have not yet fully explored this field.



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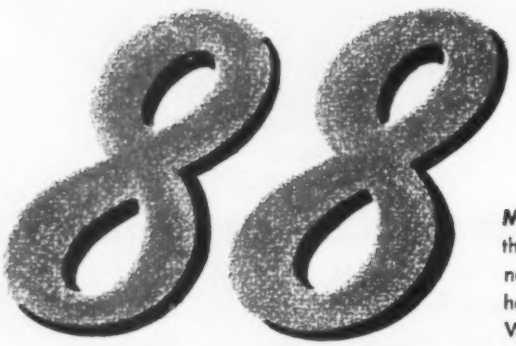

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PLASTICS*

TECHNICAL SECTION: Dr. Gordon M. Kline, Technical Editor

The Allyl Resins

by Lawrence Lynn†

When a new product is introduced to the consuming public, there is generally an induction period in its further development lasting anywhere from several months to many years. During this period much information about the product is stockpiled, including scientific data, engineering "know-how," and customer familiarity. Further, a use pattern along several basic lines becomes consolidated while the groundwork is prepared for other uses and larger volume. The allyl resins, neophyte plastics in World War II, were first introduced to a competitive economy in 1946. They are still, relatively speaking, new to the plastics field and fairly small in sales volume although a definite use pattern, mostly along specialty lines, has been established. The writer holds that given some future—and almost inevitable—drop in the cost of these resins, this induction period will become a thing of the past. Reasons for this opinion will become apparent to the reader as the story behind the allyls is unfolded in this article.

THE term allyl resins refers to the polymers and copolymers formed by either allyl alcohol or its many derivatives. The background of these resins is understandably interlinked with that of allyl alcohol, a compound known to the chemist since 1856, when Cahours and Hofmann described its preparation (34).[1] Wertheim identified the C_3H_5 radical in oil of garlic and termed it "allyl" after the Latin *allium* (garlic). A synthesis from glycerol, employing phosphorus iodide, oxalic acid, or formic acid was developed in 1870. This method became a standard laboratory procedure until in the 1930's, the Shell Development Company (52) introduced their synthetic glycerol process in which allyl alcohol appears as an intermediate.

Chemistry of Allyls

Allyl alcohol was first used in the preparation of simple derivatives, predominantly esters such as the acetate or acrylate. It is a curious fact that despite the preparation of a hard, infusible, insoluble polymer from allyl acrylate in 1873, it was commonly supposed in the years which followed, that compounds possessing the allyl configuration were incapable of polymerization (49). Within the past decade commercial uses or potentials for such use have been demonstrated by the allyl resins in molding stock, in castings of block, sheet, or film forms, in laminate stock, in coatings, varnishes, and in adhesives.

At present there are only two sources of supply for allyl alcohol, the Carbide and Carbon Chemicals Co. and the Shell Chemical Corp. Although precise figures are unavailable, present annual sales of allyl resins are estimated to be in the neighborhood of 3 million lb. per year.

Looking to the future it appears that, in view of the many interesting properties of the allyls, expanded usage will follow price reduction very closely. This family of resins is in a somewhat similar position to acrolein chemicals in that the field of potential use has vastly out distanced price and availability of the basic raw material, in this case allyl alcohol.

Allyl alcohol polymerizes very slowly and to low molecular weight products even when heated in the presence of peroxide catalyst. Under moderate pressure, one such bulk polymerization yielded amber, viscous, liquid polymers after as long as 66 hours (2). It is not surprising, therefore, that these polymers have found little use to date, although drying oils have been prepared by the esterification of the polymers with unsaturated fatty acids. Attempts to form long chain polymers of allyl alcohol have succeeded only where indirect methods were used, such as the hydrolysis of polyallyl acetals (1). The stability of uninhibited allyl alcohol, especially when cool and in the dark, greatly facilitates its storage, shipping, and handling. This relative inertness permits the use of allyl alcohol as a regulatory copolymer in those allyl polymerizations that are quite rapid. The mass polymerization of styrene and diallyl fumarate, normally difficult to control, can be made readily controllable, and gives much higher yields of the fusible, pre-gelation polymer, if as little as 10% of allyl alcohol is incorporated as a copolymer (48). Similar results have been shown in the interpolymerization of diallyl maleate, styrene, and allyl alcohol (46).

Simple Ester Formation

The allyl esters are quite different from the alcohol in that they range from extremely rapid, difficult to control, polymer-formers to essentially inert compounds. Their salient polymerization characteristic is their ability to form infusible, insoluble thermosetting resins by addition rather than condensation. Thus they are in sharp contrast to the older thermosetting resins in that no wa-

* Reg. U. S. Pat. Off.

† Head of Process Engineering Sect., Plastics Div., Summit Research Laboratories, Celanese Corp. of America.

[1] Numbers in parentheses link to references at end of article.

ter, ammonia, or other gases will be formed to complicate fabrication. This feature is important in determining the basic allyl use pattern.

To form the simple esters of allyl alcohol such as the acetate, laurate, palmitate, etc., the alcohol is combined with the acid in the presence of dehydrating or acidic type catalysts such as sulfuric or phosphoric acid. Generally, the water formed is removed by simple or azeotropic distillation. A typical ester, allyl acetate (5), follows the equation:

$$CH_2=CH-CH_2OH+CH_3COOH \rightarrow CH_2=CH-CH_2OCOCH_3+H_2O$$

Diallyl phthalate may be produced from phthalic anhydride and allyl alcohol using p-toluenesulfonic acid as catalyst or by ester exchange with dimethyl phthalate in the presence of sodium (34).

Among the most useful of the allyl esters are the chloroformates and glycol carbonates. Allyl chloroformate, one of the precursors for the carbonates, may be prepared in 95% yield (43) by the reaction of phosgene with the alcohol at 15 to 20° C:

$$COCl_2+CH_2=CH-CH_2OH \rightarrow CH_2=CH-CH_2OCOCl+HCl$$

The low temperatures suppress the formation of ring compounds. The crude product is degassed by evacuation or by stripping with air, and may be washed with cold water. Some diallyl carbonate and allyl chloride are also formed:

$$CH_2=CH-CH_2OCOCl+CH_2=CH-CH_2OH \rightarrow (CH_2=CH-CH_2O)_2CO+HCl$$

The polymeric glycol or polymeric polyglycol carbonate (28) may be made by reacting monomeric allyl chloroformate with the glycol and polymerizing the adduct:

$$2CH_2=CH-CH_2OCOCl+(HOCH_2CH_2)_2O \rightarrow (CH_2=CHCH_2OCOOCH_2CH_2)_2O+2HCl$$

Alternatively the chloroformate may be polymerized prior to the glycol reaction. Another possible and somewhat preferred method to produce the same product involves phosgenation of the glycol followed by treatment of the glycol bis-chloroformate with allyl alcohol. The polymer of allyl chloroformate can also be esterified with allyl alcohol itself (30), forming polyallyl allyl carbonate. The resin thus prepared can be catalytically converted into an extremely tough solid gel in as little as 2 hours.

Zero-Order Reaction

The polymerization of a typical allyl ester, diallyl phthalate (4), follows a zero-order reaction (41) in the early stages to give a linear or slightly branched unsaturated chain, the β-polymer. After about 25% monomer conversion, gel formation occurs resulting from the formation of the γ-polymer, a cross linked polymer. Beyond this point, the β-polymer concentration falls off sharply while that of the γ-polymer rises rapidly. Mixtures of unsaturated esters, typified by diethylene maleate and diallyl phthalate, also result in three-dimensional polymers. As the ester is heated in the presence of a peroxide, the viscosity increases gradually until the gel point is reached. Initially the gel is highly elastic but, as the heating continues, it becomes harder and tougher, finally forming a thermoset resin. The β-polymer, which is soluble in the monomer and in acetone, can be precipitated readily with methanol. Using diallyl phthalate with 2% of benzoyl peroxide, 25% conversion to the β-polymer occurs in 2 hr. at 80° C. At this point the polymer is roughly one-third as unsaturated as the monomer. The gel, on the other hand, is insoluble and amorphous, a typical space polymer.

Diallyl esters respond readily to peroxide catalysts, but slowly to light or heat. This is advantageous since little or no inhibitor is required for storage. The catalyst becomes an integral part of the polymer chain (32). This explains the existence of a final polymeric level (F.P.L.), a definite plateau in the conversion-versus-time curve which occurs when free radical formation by the catalyst ends with consumption of the catalyst. As the temperature increases, though the polymerization velocity increases, the polymers formed are softer and more elastic, the F.P.L. of the γ-polymer is lowered, and the chain length of the β-polymer is reduced. Fewer cross-links occur by primary valence bonds at higher temperatures.

Chain termination in allyl ester polymerization only partially results from catalyst consumption. It has also been shown that the peroxide-catalyzed reaction, attended by degradative chain transfer (19), is also accompanied to some extent by hydrogen extraction from the acid-derived portion of the ester or by free radical displacement reactions. In the case of allyl acetate, the chain terminating step appears to involve transfer of hydrogen from the α-position of the allyl group to a chain carrying free radical (6).

It seems anomalous that the polymerization rate of the fatty acid esters decreases as the unsaturation of the fatty acid increases. Lower F.P.L. and slower reaction can be explained (21) by the reaction of radical initiators and polymer chains with unsaturation in the fatty acid segments. These reactions give new radicals which, by radical combinations, rob the system of initiators, thereby terminating polymer chains.

Very interesting and potentially practical allyl polymerizations are offered by allyl acrylate and methacrylate (27). These compounds contain two functional groups of quite different polymerization tendencies. During the early stages of polymerization, the allyl group is mostly unreacted while the methacrylate polymerizes quickly. Although when completely polymerized a useful thermoset resin is formed, early gelation poses problems in casting or molding, particularly in large or complex shapes. Moderately high conversions to the β-polymer before gelation may be approached in two ways (15, 42, 50): by decreasing early reactivity in the allyl group or by reducing chain length during the early stages of polymerization. Polymerization at lower temperatures or the addition of suitable additives will accomplish these ends. The effect of lower temperature depends on the difference in the activation energies of the various reactions prior to gelation (14). Using β-thionaphthol as an additive, conversion at gelation is increased from 6% to 28%, and pre-gelation reaction time is extended from 8 to 27 min., thus affording much better control.

Chain Transfer Agents

In contrast to the vinyl halides, allyl halides react slowly to form low homopolymers (33). Although they copolymerize with compounds such as vinyl chloride, they act as chain transfer agents and tend to

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lower the net rate of polymerization. Advantage of this behavior has been taken (45) by using these compounds to increase the pre-gelation reaction time in rapid allylic polymerizations, for example, in that of diallyl phthalate and dimethallyl phthalate. The presence of allyl chloride in such a polymerization mix also tends to raise the yield of soluble polymers.

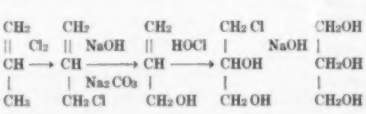
Two-stage polymerization is also found in the allyl ethers (8). A number of allyl ethers of allyl phenols were found to form thermoplastic resins (β-polymers) when using boron fluoride as catalyst. The allyl side chains were not involved in the formation of the β-polymers, though they reacted on gelation.

Vinyl allyl ethers (9) show interesting behavior in their stability toward peroxide catalysts. However, they polymerize readily with Friedal-Crafts catalysts. This would tend to show such polymerizations to proceed by ionic rather than free radical mechanisms, in contrast to the allyl class in general. Another allyl anomaly, found in the polymerization of the acetate (38, 39), may be more difficult to explain. Copper is a well known inhibitor (23) toward polymerization at an olefinic linkage. Normally it is used as such in esterifications or distillations involving allyl, vinyl, or similar compounds. Yet, under non-oxidizing conditions and at higher temperatures, e.g., over about 185° C,, copper becomes a catalyst. The low cost of copper makes its use as a polymerization catalyst an intriguing possibility worthy of further study, especially since the same substance can be used as the inhibitor merely by changing conditions of temperature and pressure.

Raw Materials

Since the list of raw materials for the synthesis of allyl resins of present or potential value is patently vast, especially if the dyes, plasticizers, monomers, and minor ingredients used are considered, only a few selected materials can be reviewed. Aside from allyl alcohol, allyl chloride, and allyl ether, these include such compounds as phthalic and maleic anhydrides, glycols, and starch or sucrose.

Allyl alcohol is made commercially as an intermediate in the synthetic glycerol process. This process (52), shown schematically in Fig. 1, starts with propylene recovered from cracked refinery gases in 98% purity. This high purity is required in order to save chlorine in the first step of the process, the "hot chlorination," and to depress the formation of chloropropane compounds, which complicate the recovery of allyl chloride. The chlorination occurs at 500° C., a temperature at which propylene reacts by substitution rather than addition, and produces allyl chloride in 85% yields. The by-products, HCl, 2, 3-dichloropropene, dichloropropanes, and others, are separated by extraction and distillation. The second step is a hydrolysis with soda ash and caustic, which occurs at about 150° C. and 200 p.s.i. Yields in this step are 90 to 95%; some allyl ether is produced as a by-product. Azeotropic distillation is used to recover dry allyl alcohol. The reactions involved in the glycerol process are as follows:



Other possibilities for allyl alcohol production have been considered including the oxidation of propylene, for which few data are available, and the isomerization of propylene oxide. In the latter case, conversions of 30 to 50% to allyl alcohol plus 3 to 16% to propionaldehyde have been obtained catalytically at 250 to 500° C. (25). Attempts to produce allyl esters by simpler or more direct methods have not been very fruitful. One possibility, which may be developed further in the future (29), uses a mixture of ethylene, formaldehyde, and organic acids under pressure to form esters of propylene glycol. The di-ester can be thermally converted to allyl esters in an inert atmosphere, but yields leave much to be desired. The oxidation of methallyl alcohol to methacrolein and thence to methacrylic acid has been demonstrated (12). The possibility of a partial oxidation to the acid in the presence of an excess of the alcohol and an esterification agent might be developed into a satisfactory direct route to methallyl methacrylate. Successful development of a direct allyl ester synthesis would be a notable achievement.

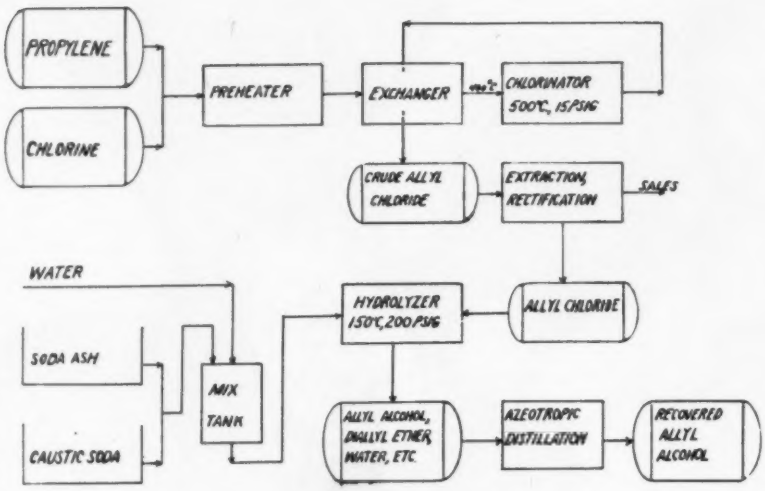


Fig. 1—Schematic flow diagram for production of allyl alcohol from propylene

Allyl sucrose has been prepared from allyl chloride and sucrose in over 90% yields (54). This viscous amber monomer can be prepared by the reaction of the halide, sucrose, and caustic in an autoclave, removal of the salt, steam distillation of volatile by-products, and extraction with toluene or vacuum drying. A 2.5 million-lb.-per-year unit would cost about $300,000 and produce the monomer for 34¢/lb. (20) if allyl chloride is charged at 15¢ per pound.

Prices and Production

The price performance and production history of several allyl raw materials appear in Fig. 2.* The prices

* Figure 2 appears on page 144.

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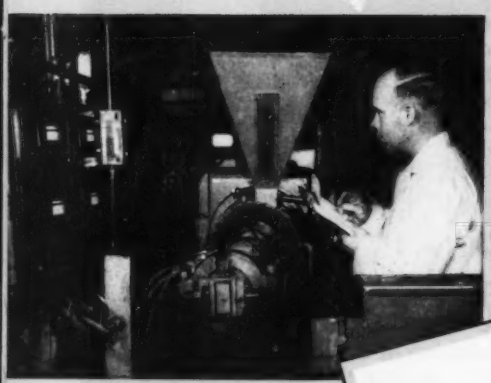
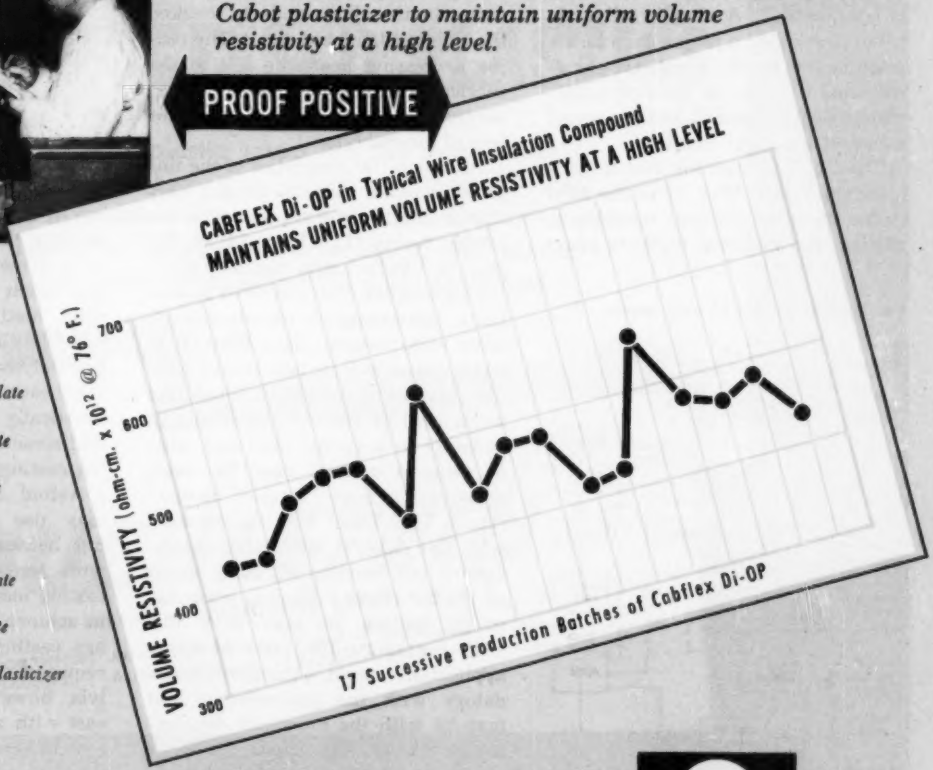


Courtesy of The Rex Corporation, West Acton, Mass.

PROOF POSITIVE



- **Cabflex Di-OP** *di-iso-octyl phthalate*
- **Cabflex Di-OA** *di-iso-octyl adipate*
- **Cabflex DDP** *di-decyl phthalate*
- **Cabflex DDA** *di-decyl adipate*
- **Cabflex Di-BA** *di-iso-butyl adipate*
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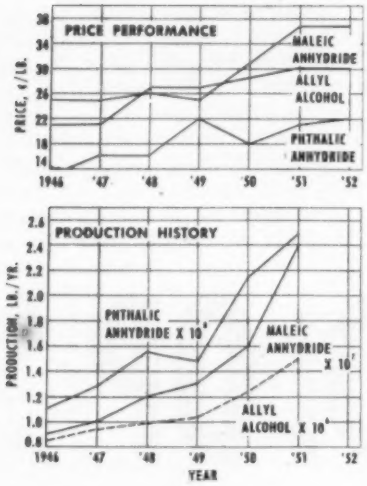
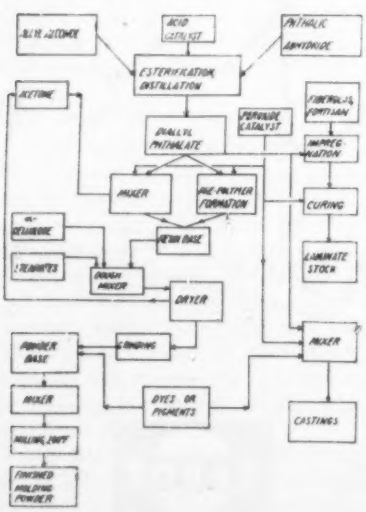


Fig. 2—Price-production background for several allyl resin raw materials

of the common dibasic acids have been fairly stable. Allyl alcohol's price and availability are necessarily linked to the fortunes of glycerol and the increase in the molecular weight which occurs in the conversion of the alcohol (M.W. 58) to glycerol (M.W.92) at the expense of relatively cheap inorganic materials is considerable. A simpler allyl alcohol process or a major drop in the price or market for synthetic glycerol would result in greater availability of this alcohol and increased usage of the allyl resins.

The field of uses for and techniques applicable (Fig. 3) to the allyl resins include primarily laminating, casting, and molding, thinking again

Fig. 3—Manufacture of allyl plastics



in terms of present or potential usage. To date it appears that films, coatings and varnishes, adhesives, and others will play only minor roles in the development of new allyl applications.

Technology and Uses

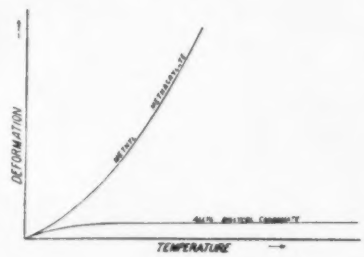
Two salient features of the allyls have guided adoption of their basic use pattern and will continue to influence further applications. One is the possibility of using two-stage polymerization. The use of pre-polymer cuts cure time and flow during the cure cycle. The other is the fact that by undergoing addition polymerization, the problem of water reaction, ammonia vapors, or generation of other by-products is obviated in the formation of plastic forms. This not only permits the allyls to be used with very low molding or laminating pressures, thereby making hydraulic presses and other high compression machinery unnecessary, but also in many instances leads to improved articles of manufacture. The formation of water during the cure cycle of a laminate complicates the processing and the absorption of some of this water in the cloth tends to weaken the finished laminate stock. The major processing headache left to the fabricator using allyls for thermoset laminates is the time-honored problem of air-bubbles.

Although the properties of the finished laminate depend on the particular allyl resin used, the many usable resins (13, 17, 18, 24, 26, 36) may be handled with basically similar techniques. The choice of a laminate reinforcement affords a similarly wide choice; glass fiber, Fortisan, paper, cotton, and others have been found satisfactory. Since the allyls cure by addition, only enough pressure to keep the plies and resin in intimate contact need be used, whence the term "contact lamination." The plies are impregnated with the catalyst containing monomer or pre-polymer by such means as doctor blades, dipping, spraying, or by feeding the resin into cells (44) containing the plies. If spray application is used, a thinner is mandatory with the pre-polymer and may be with the monomer depending on its viscosity. Contact may be maintained by the use of sand-bags, screw-clamps, cells, inflatable rubber bag "molds," or wrapping with film and taping. Ideally, if molds are used, only one of the walls should be kept rigid. Heat may be supplied most easily by laminating in large air-ovens or by using hot plates. Curved shapes are preferably cured in the final desired shape to insure a maximum of dimensional stability. The cure must be complete or else a lachrymatory odor will be left with the product, necessitating special means (22) for removing the residual monomer.

Cast Allyl

Allyl cast plastics are unique in that they afford transparent, thermally stable products. They can be tailor-made as to hardness, color, and flexibility (7, 40). The qualitative deformation comparison between two optically useful types of castings, methyl methacrylate and an allyl glycol carbonate, illustrates (Fig. 4) an advantage for the allyl casting (31). While permitting

Fig. 4—Allyl vs. acrylic



roughly the same light transmission as polymethyl methacrylate, allyls are much more abrasion resistant than methacrylate, though somewhat less so than glass. The use of pre-polymer feed in casting requires some caution; although it will lead to drastically reduced cure time, color will sometimes appear in the resulting castings.

Actual castings of allyl plastics may use conventional equipment, but because of the high shrinkage with some allyls, up to 15%, die casting may be impractical. In order to achieve accuracy in high shrinkage castings, special molds may be required. Goodrich's "Kriston" allyls, however, are claimed (7) to cast with as little as 3.25% shrinkage. In general, casting may use ferrous or non-ferrous molds, but if glass or metal molds are used, no

(*Continued on p. 219*)

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Melt Flow of Polyethylene

Measurement by means of a simple extrusion plastometer

by J. P. Tordella* and R. E. Jolly*

Measurement of the melt index of polyethylene with the simple extrusion plastometer described herein has proved reliable, rapid, and convenient. Only minor instrument maintenance has been required over a period of more than three years. The combination of high precision plus the economy and ease of operation have made this method of measuring melt flow most satisfactory.

USE of melt flow characteristics as the basis for the classification of the various grades of polyethylene is now well established. Parallel plate plastometers and orifice-type extrusion plastometers have both been used for this purpose. The parallel plate plastometer (1)[1] is attractive because of its simplicity and because it yields data from which viscosity may be readily calculated. However, the precision of this instrument appears to be less than is required by the present technology of polyethylene processing. The very simple extrusion plastometer described in this paper has features of design that were determined by detailed study of the factors that limit the precision of such devices. It is quite similar to the British instrument (2) that is used for the same purpose. There are, however, significant differences which contribute markedly to the precision and to the ease of operation. Recently the American Society for Testing Materials has issued Tentative Method of Test for Measuring Flow Rates of Thermoplastics by Extrusion Plastometer, D 1238-52T, based on the instrument described in this article. Classification of fluorothene resins in a similar instrument was described recently by F. D. Dexter (3).

The usefulness of the instrument, which has been called the melt indexer, has been demonstrated by more than two years' experience in several laboratories of different industrial organizations. The test is primarily a classification test and flow data more extensive than specified by the test may be necessary for prediction of flow rates at conditions other than those pertaining at the time of test.

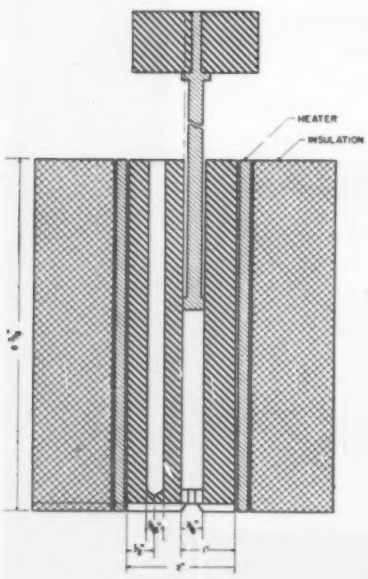

Fig. 1—Cylinder of melt indexer

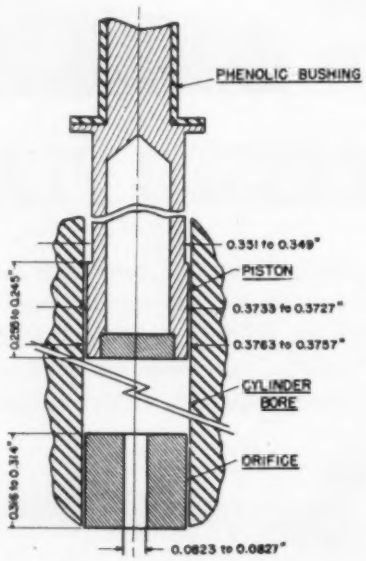

Fig. 2—Detail of piston and orifice

The Melt Indexer

The melt indexer consists of a steel cylinder, thermostatted for control at two temperatures, a piston fitted to the cylinder, two weights, and one orifice. Figure 1 is a sketch of the cylinder. More details are given in Fig. 2, and Fig.

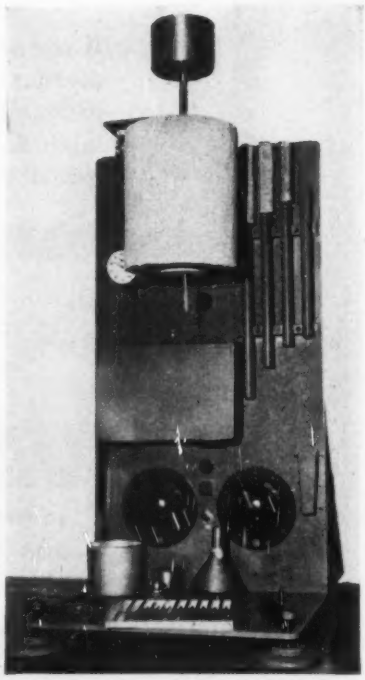

Fig. 3—Over-all view of melt indexer

* Research Div. and Control Div., respectively, Polychemicals Dept., E. I. du Pont de Nemours & Co., Inc.

[1] Numbers in parentheses link to references at end of article.

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Table I—Effect of Piston Clearance on Flow Rate

Diameter			
Piston	*Cylinder*	*Clearance*	*Flow-Rate*
in.	in.	in.	*g./10 min.*
0.375	0.376	0.001	2.60
0.370	0.376	0.006	2.87
0.364	0.376	0.012	2.98

3 is a photograph of the complete instrument.

In the construction of the cylinder, suitable techniques are employed to assure a smooth uniform bore. Heat loss from the insulated cylinder is minimized 1) by using phenolic flanges to mount the cylinder on the upright panel, 2) by making the piston hollow to reduce its thermal mass, and 3) by placing a phenolic bushing between the piston and the weight to provide thermal insulation.

The cylinder and all accessories are mounted on a substantial base equipped with screws for leveling. The "pipe organ" on the upright panel holds the piston and the loading and cleaning tools. The flat box contains the thermometer and thermoregulator for the alternate operating temperature. The stopwatch for timing the operation is also mounted on the upright panel. The tray for extruded samples, the loading funnel, the second weight, and the container for cleaning patches are mounted on the base panel. The small bubble level is used on top of the cylinder to level the instrument. In addition, there are forceps to hold the orifice during flame cleaning, a phosphor bronze-tipped spatula which serves as a cut-off tool, and gages to check the bore size of the orifice. The only additional items required for operation are a burner and an analytical balance.

Rate of Flow

There are three factors that affect the rate of flow of a plastic in this instrument. These factors and the methods used to control them for polyethylene are as follows:

Temperature — High-sensitivity mercury thermoregulators, one for each temperature, are used for automatic regulation. A two element electric band heater, each element with its own variable transformer, is used for heating. One element runs continuously with power input sufficient to maintain the cylinder at 10 to 15° below the desired operating temperature. The other element is operated intermittently, controlled by the mercury thermoregulator and associated electronic relay at a power input sufficient to restore the cylinder to temperature about 2 min. after charging a sample. Foamed glass, covered with a thin layer of asbestos and Portland cement, is used for thermal insulation. Since the cylinder is not heated at the top or bottom, thermal gradients of 1 to 2° C. are unavoidable. Uniformity of these gradients among the several instruments manufactured to date has been achieved by close uniformity of cylinder dimensions, heaters, thermoregulators, thermal insulation, and conditions of operation.

Pressure—The pressure is determined by the area of the piston and its weight less the force of friction, or viscous drag, between the piston and the cylinder. The increase of flow rate with increasing diametral clearance is about $1.3\%/10^{-3}$ in. (Table I). This variable is adequately controlled by holding the clearance of 0.003 in. within ±0.0006 inch. This clearance is large enough so that minor surface imperfections in the bore do not affect flow noticeably, but small enough so that the film of polyethylene remaining on the walls can be removed easily in the cleaning operation which should follow each determination.

Orifice Size—Small variations in orifice diameter greatly affect the rate of flow, while variations in length of orifice have a much smaller effect. Accordingly, the orifice holes are lapped to a diameter of 0.0825 in. ±0.0002 in. and machined to a length of 0.315 in. ±0.001 inch.

Test Procedure

The weight in grams extruded in 10 min. through the specified orifice at 190° C. by a loaded piston weighing 2160 g. is called the melt index for polyethylene. Flow rates of low molecular weight polyethylene resins and high molecular weight waxes are too high for practical measurement under these conditions. Two alternate conditions are used with these materials: 190° C. with a load of 325 g. on the piston; and 125° C. with a 325-g. load. The relation between flow rates measured under these conditions and melt index is shown in Fig. 4 and is discussed later.

The exact procedure followed depends on the melt index of the sample used. In general, the sample in any convenient form (powder, cubes, or strips of film or molded sheet) is charged through the funnel. A 5-min. heating period is allowed for the sample to come to temperature. At the end of this period the extrudate is cut off at the orifice and discarded preparatory to collection of extruded specimens. The number of specimens collected, the extrusion time, and, as mentioned above, the conditions of extrusion vary with the melt index of the sample. The various operating details are presented in Table II, which appears on page 150.

After the collection of specimens, the cylinder is emptied by hand pressure, and the piston is removed and wiped clean. The orifice is pushed out the top and burned clean, and the cylinder base is cleaned with cloth patches after the manner of cleaning a pistol bore. The extruded portions are weighed to an accuracy of ±1% and the flow rate in grams per 10 min. is calculated.

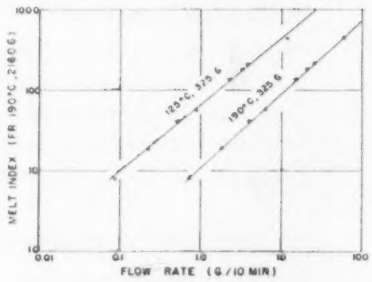

Fig. 4—Flow rates vs. melt index

The flow rate is converted to melt index by use of Fig. 4 if conditions other than 190° C., 2160-g. load were used. A complete determination in-

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Table II—Operating Procedures

Melt Index Range	Conditions	Specimen Collection Extrusion Number	Time	Flow Rate
			min.	g./10 min.
0.1–0.7	190°C./2160 g.	1	6.00	0.1–0.7
0.7–10	Do.	1	3.00	0.7–10
10–80	190°C./325 g.	1	3.00	1–10
80–600	125°C./325 g.	1	3.00	1–10
600–1000	Do.	5	0.50	10–20
1000–2200	Do.	1–5[a]	0.50	20–50
2200	Do.	1[b]	Measure	>50

[a] It is necessary to plug the orifice to avoid loss of the sample during the preheat period. Specimens are collected until the sample is completely discharged.
[b] Also necessary to plug the orifice during preheat. The time for complete discharge is measured.

Table III—Flow Rates for Polyethylene Samples at the Three Different Conditions

Sample	Flow Rates 125°C./325 g.	190°C./325 g.	190°C./2160 g.
	g./10 min.	g./10 min.	g./10 min.
1	0.085	0.73	8.02
2	0.220	1.83	18.8
3	0.500	3.95	41.2
4	0.865	6.33	57.4
5	2.23	15.0	136.0
6	3.23	20.8	183.0
7	3.77	25.2	213.0
8	11.62	59.5	455.0
9	45.5	215.0	—

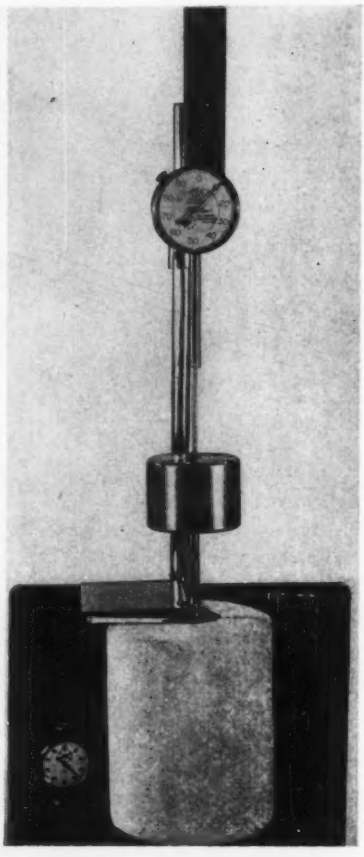

Fig. 6—Use of dial gage for volumetric measurement of flow rate

cluding cleaning, weighing, and calculation requires 20 to 25 minutes. Appreciable saving of time has been achieved by simultaneous operation of two instruments.

Flow rates measured with the 325-g. load at either 125 or 190° C. are converted to equivalent flow rates at 190° C., 2160-g. load by means of the relations plotted in Fig. 4. This figure is the result of experimental measurements. Flow rates of nine different polyethylene samples were measured under all three conditions. The data are given in Table III and are plotted in Fig. 4. The following equations were obtained from the data by the method of least squares:

$$\text{Log melt index} = 0.830 \log F_{125/325} + 1.825 \ (\pm 0.082) \quad \text{(Eq. 1)}$$

$$\text{Log melt index} = 0.921 \log F_{190/325} + 1.039 \ (\pm 0.038) \quad \text{(Eq. 2)}$$

The values in parentheses following the equations are the reliabilities (at the 95% confidence level[2]) of the calculated values of log melt index. The correlation coefficients, 0.9986 for equation 1 and 0.9967 for equation 2, indicate better than a thousand-to-one probability of a linear relation of the type assumed between melt index and flow rate under the other two conditions.

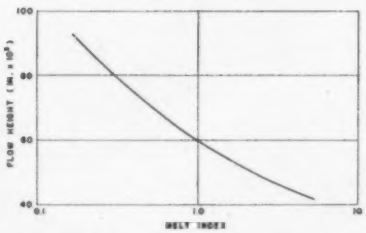

Fig. 5—Melt index vs. flow height

Table IV—Reliability[a] of Test Averages

Average Melt Index Value	Reliability Absolute	Percentage
4.29	±0.296	±6.9
2.98	±0.182	±6.1
2.59	±0.316	±12
1.48	±0.131	±8.9
0.98	±0.081	±8.2
0.86	±0.100	±11.6
0.85	±0.103	±12.2
0.51	±0.057	±11.2
0.48	±0.072	±15.1

[a] 95% confidence limits, i.e., 19 out of 20 averages should fall within these limits.

[2] In 19 out of 20 determinations, results should be within these limits.

Parallel Plate Plasticity

The other common instrument for measuring flow properties of polyethylenes is the parallel plate plastometer. An approximate relation between melt index and flow height measured with the parallel plate plastometer is shown in Fig. 5.

Reliability of Index Values

A round robin test was conducted between eight different laboratories using nine different polyethylene samples to estimate the reliability of the method. At least duplicate determinations were made on each sample. The results are summarized in Table IV.

(*Continued on p. 229*)

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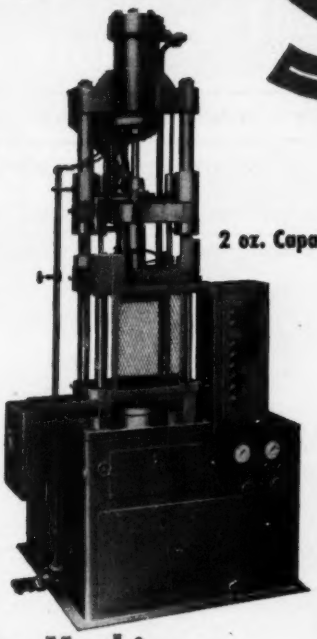

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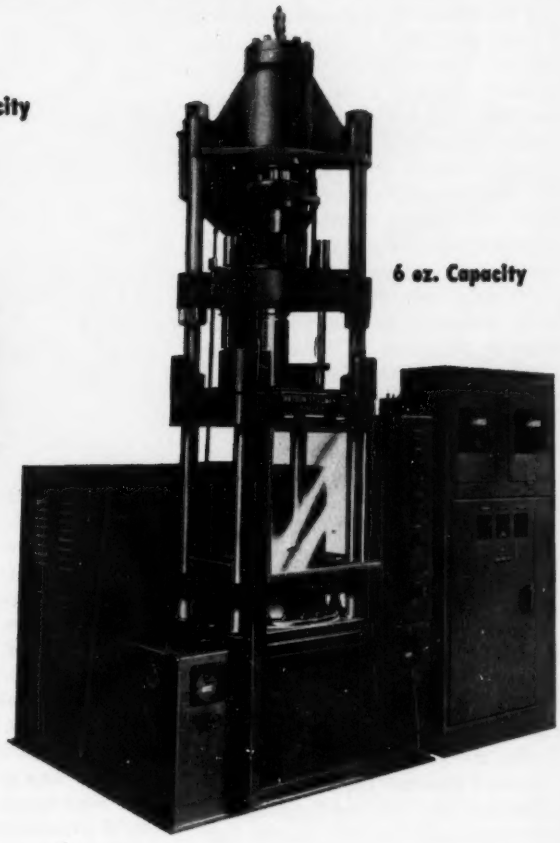

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Radiation of Polytetrafluoroethylene

Decomposition by high-level gamma rays*

by J. W. Ryan**

IN an attempt to find an insulation which is resistant to gamma radiation and relatively high temperature, it was felt that much could be learned from a study of the end products of materials that have been irradiated. Such a study should give insight into some of the chemical reactions which are responsible for the mechanical changes that have been observed to occur.

Polytetrafluoroethylene (Teflon) was chosen for investigation because relatively small doses of radiation bring about major changes in mechanical properties[1]. The formation of fluoride ions from Teflon was observed at the Oak Ridge National Laboratory[2]. It is a readily available material and, as commonly supplied, it consists of a simple polymeric system free of fillers and other admixtures. Polytetrafluoroethylene also has a fairly well ordered crystal structure and lends itself to X-ray diffraction methods of analysis. The inertness of this material is so well established that changes in chemical reactivity would provide conclusive proof of the occurrence of basic chemical changes in the molecule of this compound.

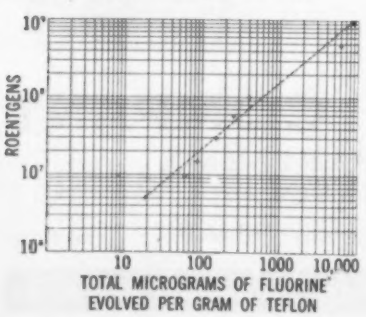
Table I presents the concentration of fluoride ions detected immediately after removal from the source and after a lapse of 30 days following the exposure.

The Teflon test specimens were exposed in polyethylene bottles under a dilute sodium hydroxide solution. These irradiations were made in a Co^{60} source and various dosages were attained by allowing the sample to remain in the source for varying periods of time.

Table I—Evolution of Fluorine from Irradiated Teflon

Total Irradiation	*Fluorine evolved per gram of Teflon*		
	During Irradiation	*30 Days after Irradiation*	*Total*
Roentgens	*micrograms*	*micrograms*	*micrograms*
5×10^6	3.6	18.4	22
7.3×10^6	27	--	--
1.0×10^7	54	7.4	61.4
1.5×10^7	46	40	86
3×10^7	79	63	142
6×11^7	159	91	250
1×10^8	261	133	394
2×10^8	593	--	--
3×10^8	758	--	--
5×10^8	5420	320	5740
1×10^9	8600	352	8952

Fig. 1—Fluorine evolution from Teflon exposed to high level gamma rays



A log-log plot of the total fluorine evolution versus total radiation exposure is presented in Fig. 1. A rough estimate of the amount of fluorine evolved for the exposures of 5×10^6 to 1×10^9 R. can be expressed as follows:

$$X = 3.78 \times 10^{-7}(Y)^{1.151}$$

where X = micrograms of fluorine observed per gram of Teflon and Y = Roentgens. The dotted line in Fig. 1 represents this equation.

A Teflon disk which had received 10^8 R. was powdered, suspended in mineral oil, and then subjected to infra-red analysis. The spectrum from the irradiated Teflon showed two maxima not present in the spectrum determined with a 1-mil film of the non-irradiated Teflon. These maxima (wavelengths 5.7 and 6.5 microns) could be ascribed to the formation of $-\overset{F}{\underset{}{C}}=\overset{F}{\underset{}{C}}-$ and $-\overset{F}{\underset{}{C}}=\overset{F}{\underset{}{CF}}$ bonds. Double bond formation was further evidenced when irradiated specimens (5×10^7 R.) decolorized an acid solution of 0.0023 N potassium permanganate in less than three days. A control showed only slight change. An attempted bromine addition produced no positive results after two weeks of standing.

The detailed results of the X-ray diffraction studies conducted are beyond the scope of this paper and will not be presented here. Teflon is thought to be composed of extended polymeric chains packed on a hexagonal grid with adjacent chains rotated with respect to each other so that the crystallographic repeat unit requires 12 chains, each chain direction consisting of 14 or 15 CF_2 units spirally disposed about the major fiber axis. After irradiation the patterns had changed in such a manner as to indicate that the repeat distance of the fiber had decreased. This strongly suggests that new bonds in the chain (such as $-\overset{F}{\underset{}{C}}=\overset{F}{\underset{}{C}}-$ or $-\overset{F}{\underset{}{C}}=\overset{F}{\underset{}{CF}}$) had been formed.

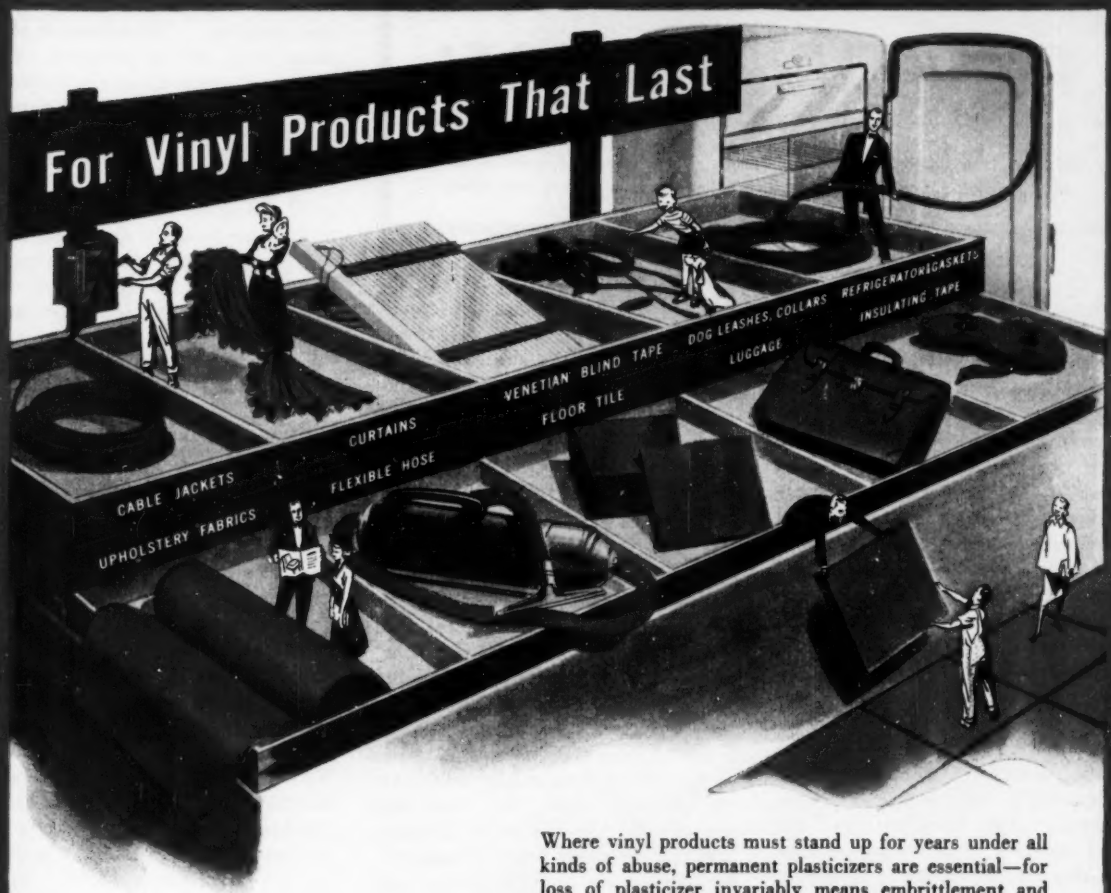
The results of this work show that the mechanical deterioration of Teflon in high level gamma radiation is accompanied by the formation of double bonds which arise upon the evolution of fluorine. Data show that the rupture of one C-F bond in as few as 1000 can bring about major changes in mechanical properties, as evidenced by the fluorides found after a total irradiation of 10^7 Roentgens. Studies of average molecular weight or of solubilities could not be undertaken because of the inertness of this material.

* Work done under AEC Contract W-31-109-Eng 57.

** General Engineering Laboratory, General Electric Co

[1] Sisman and Bopp, "Physical Properties of Irradiated Plastics." Oak Ridge National Laboratory Report No. 928.

[2] C. D. Watson, Oak Ridge National Laboratory, private communication.



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PLASTICS DIGEST*

Abstracts from the world's literature of interest to those who make or use plastics or plastics products. Send requests for periodicals to the publishers listed.

Materials

FINISHES FOR GLASS FABRICS FOR REINFORCING POLYESTER PLASTICS. L. P. Biefeld and T. E. Philipps. Ind. Eng. Chem. *45*, 1281-86 (June 1953). Fibrous glass fabrics contain an oily starch size which makes them unsuitable for reinforcing polyester plastics. The fabrics must be desized and finished with an agent that promotes fiber wetting by the uncured plastic and fiber adhesion to the cured plastic matrix. The finishing agents used are glass-to-polyester coupling agents; they possess dual chemical functionality. One part of the molecule reacts with the fiber surface, the other part with the plastic matrix. Organo-silicon or organo-chromium compounds are generally used. They not only can bond securely to the glass surface, but also contain unsaturated organo groups which can react with the active, unsaturated groups in the polyester. Moisture has very little effect on the bonds. Polyester plastics reinforced with suitably finished fabrics have high strength-weight ratios and dimensional stability, resist moisture, and do not corrode. They are used extensively in the aircraft industry.

CONDUCTIVE PLASTICS IN ANALOG COMPUTERS. C. J. Nisson. Elec. Manuf. *51*, 156-7 (June 1953). Special tests and actual use indicate rectilinear potentiometer elements constructed of a conductive plastic are satisfactory. The conductive plastic unit replaces elements previously made of winding of 1.5-mil nickel-chrome wire having an overall resistance of 20,000 ohms.

ANNEALING OF POLYSTYRENE. F. J. Parmenter. Brit. Plastics *26*, 154-9 (May 1953). A brief survey of the types of internal stress apparent in injection molded polystyrene is made together with some indications as to the conditions under which the various types of stress may be alleviated during molding operations. It is shown that mechanical stresses may be removed by subsequent annealing. Ordinary short-time annealing techniques have little effect on non-equilibrium stresses or on orientation stresses. These conditions require long-time annealing cycles. General annealing procedures are included.

LEAD STABILIZERS FOR POLYVINYL CHLORIDE. C. F. Weider. Kunststoffe *43*, 102 (Mar. 1953). Because lead stabilizers are capable of absorbing acid they are suitable for increasing the heat and light stability of polyvinyl chloride. There are several types of lead stabilizers used, basic and normal compounds, inorganic and organic ones. The basic lead compounds are the most effective and the following are the most important among them: tribasic lead sulfate, dibasic lead phosphite, dibasic lead phthalate, and dibasic lead stearate.

PLASTIGELS . . . PRODUCTION AND USES. E. T. Severs. SPE J. *9*, 13-15, 72 (June 1953). The formulation, preparation, and uses of plastigels are described. Plastigels, a new application of vinyl resins, offer promise to plastic fabricators. At the present time, molders and extruders have the mechanical ingenuity and tools for fabricating plastigels, while many print and specialty coating manufacturers already have a backlog of experience with vinyl dispersion resins, which should help in formulating plastigels for production on the present equipment.

POLYMERIZATION OF CHLOROTRIFLUOROETHYLENE. J. M. Hamilton, Jr. Ind. Eng. Chem. *45*, 1347-50 (June 1953). A suitable polymerization system for chlorotrifluoroethylene, in which silver nitrate is the promoter, was developed. Using this system the effect of several variables on the amount of polymer formed and its quality was determined. The variables studied were silver ion concentration, monomer-aqueous phase ratio, pH, temperature, agitation, and mechanical contaminants such as grease and iron. The impurities present in chlorotrifluoroethylene made by the dechlorination of trichlorotrifluoroethylene in alcohol were identified and the mechanism of their formation is discussed. Their effect on the quality of polymer obtained using the silver nitrate-catalyzed polymerization system is evaluated.

Molding and Fabricating

A STATISTICAL STUDY OF EXTRUSION VARIABLES. R. E. Colwell. SPE J. *9*, 16-17, 76-71 (June 1953). Three concepts are discussed. First, if a reasonably simple experimental design is used, the analysis of variance can be obtained directly from the pattern of plus and minus diagrams. The analysis of variance by rank is equally simple. Complex designs should be developed and treated by experienced statisticians. Second, one can study a complex operation such as extrusion with facility even though the variables can not be related analytically. And third, the practical goal of any experimental work is to improve quality, reduce cost, increase capacity, or develop new products. This goal can be achieved without completely understanding the absolute relationships between variables. There is a practical limit beyond which one can not afford to attempt a theoretical solution to a problem. Extrusion as a whole may be beyond that limit although we can profit greatly by idealized theoretical studies of particular aspects of extrusion. These factual conclusions can be obtained from the experiments which are discussed. One screw has a 25% higher extrusion rate than another; this is attributed primarily to its lower compression ratio. A 50% increase in screw speed resulted in a 25% increase in extrusion rate; this is equivalent to 4 lb./hr./revolutions per minute. Material containing 0.0% or 1.0% additive had a 20% higher rate of extrusion than material containing 0.1% additive. The particle size of the feed material did not influence the rate of extrusion. Screw cooling reduced the rate of extrusion. Increasing the temperature of the feed material increased the rate of extru-

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sion by ½ lb./hr./°F. The effects of the variables on extrusion rate were additive, that is all of the separate effects could be combined to give a maximum rate of extrusion. Although not evident from the data presented it was found that in general when one increased the rate of extrusion the quality level was reduced. One must balance such results in defining optimum mode of operation.

Applications

FILM-WRAPPED LEMONS. Modern Packaging, *26*, 98-101 (Mar. 1953). A discussion is given of the desirability of packaging lemons in a transparent wrap. A total wrap proved to speed up mold action so an almost total wrap was developed. Pliofilm of 0.0002-in. thickness is wrapped and sealed on the lemon, but air gaps are left in the seals. Details of the machine and machine operation are given.

VACUUMIZED DILLS. Modern Packaging *26*, 78-9, 176 (Mar. 1953). A packaging procedure is discussed for packaging dill pickles in their natural brine. The package, a pouch type, is made of a laminate of cellophane outside and polyethylene inside, and is prefabricated with heat seals on three sides. The bags are filled and evacuated to 28 in. of mercury, and the final seal is made.

P.V.C. FOR BATTERY SEPARATORS Brit. Plastics, *26*, 123-35 (Apr. 1953). The manufacture of micro-porous polyvinyl chloride battery separators is described. The possibilities for this material in other applications are also considered. The use of this material has resulted in improved battery performance and longer life. An all-dry assembly is possible and batteries may now be stored for an indefinite period before use. The replacement of wood separators has brought about a considerable saving in costs.

ACRYLIC CORNEAL LENSES. Brit. Plastics *26*, 142 (Apr. 1953). Acrylic corneal lenses, less than ½ in. in diameter, are described. The lenses are very easy to fit requiring no plastic cast of the eye as for glass contact lenses.

POLYVINYL SLEEVINGS AND WIRE COVERINGS FOR ELECTRICAL INSULATION. E. E. Halls. Plastics (London) *18*, 131-134 (Apr. 1953). As a covering, polyvinyl chloride provides the electrical properties required, i.e., a specific power factor, high electric strength, good insulation resistance, and retention of the latter under damp conditions. By selection of grades of proper composition, dimensional stability is sufficient for the purpose in question. Thin walls and small internal diameters are procurable in sleevings, and reasonably thin extrusion with continuity are practicable as wire coverings. The material has shown no susceptibility to deterioration under service conditions involving industrial atmospheres. Colors are obtainable for distinguishing cabling. The economic position is satisfactory in comparison with older products. The extruded polyvinyl chloride sleeving has largely replaced the impregnated or coated textile sleevings in the light electrical industries. The shortcomings found in practice are gradually being eliminated, chiefly by techniques, but in many cases by better selection of material, i.e., appropriate plasticization to suit the practical conditions to be met. Further advances are required to render nonmigratory plasticizers more generally available and to establish specification standards for essential grades. A British standard is in preparation for the wide range of cables and flexible cords used for electric power and lighting up to 250 v., insulated with polyvinyl chloride.

MICROFILTRATION WITH RESIN-IMPREGNATED WOOL FILTERS. E. D. Kane. Ind. Eng. Chem. *45*, 860-64 (Apr. 1953). A microfilter made by impregnating wool and cellulose fibers with phenolic or modified phenolic resins is described.

SYMPOSIUM ON EMULSION PAINTS. A group of ten papers by 18 authors. Ind. Eng. Chem. *45*, 709-54 (Apr. 1953). The latest development in water-thinned coatings are latex paints in which the copolymers and polymers of butadiene, styrene, vinyl, vinylidene, and other chemicals serve as binders. These products have qualities possessed by no other type wall coating. The copolymer composition determines such properties as adhesion, gloss, and scrub resistance. The emulsifying system influences these properties and also is the major factor in controlling stability and viscosity of the emulsion. Particle size has a unique effect on the scrub resistance, gloss, and tensile strength of the polymer film.

PLUMBING IN POLYTHENE. Brit. Plastics *26*, 153 (May 1953). Sink waste traps are now being molded of polyethylene in considerable quantities for industrial and general domestic plumbing systems. This trap has the advantages of compactness, chemical resistance and ease of installation. Its main drawback is its low heat resistance.

BONDING PLASTICIZED P. V. C. TO METAL. A. Blake. Brit. Plastics *26*, 160 (May 1953). It is generally difficult to obtain a lasting bond between metal and a plasticized polyvinyl chloride composition because the plasticizer migrates to the adhesive layer and breaks down the adhesion. A method is discussed where a thin semi-rigid layer of polyvinyl chloride is bonded to the metal and the plasticized layer is bonded to this by heating.

MECHANIZED PRODUCTION OF FOUNDRY SHELL MOULDS FROM RESIN-SAND MIXTURES. Plastics (London) *18*, 35-37 (Feb. 1953). The potential consumption rate of resins in the shell molding process is discussed, as well as economic advantages of this process and types of resins suitable for use in the process. A specially designed machine which mechanizes the operations used in the shell molding process is described. This machine removes the actual control of the basic elements of the process, such as oven temperature and cycle time, from the operator. The machine has four stations, at each of which the mold is worked upon, so that the output of molds is equal to that of four ordinary operators making shell molds by hand. The output is equal to 60 complete molds per hour. It is claimed that this machine produces absolutely consistent molds, sets the pace for the rest of the foundry, and will normally pay for itself in less than a year.

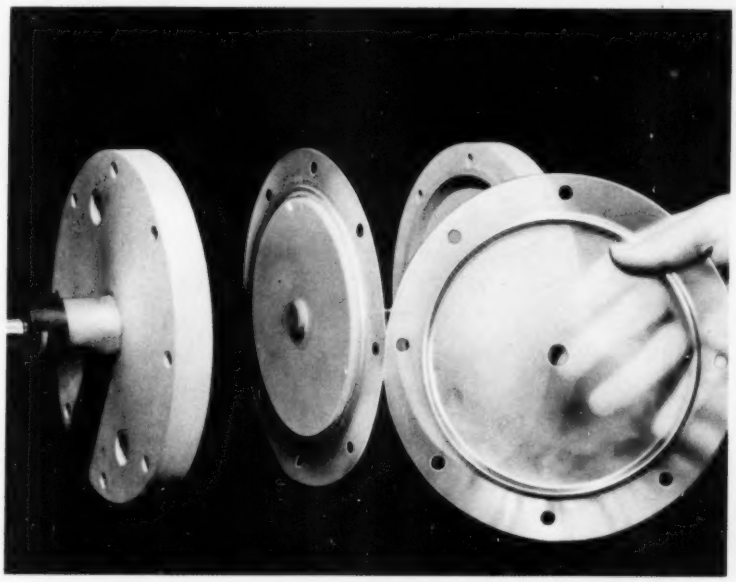
IMPROVED PORTLAND CEMENT MORTARS WITH POLYVINYL ACETATE EMULSIONS. J. M. Geist, S. V. Amagna and B. B. Mellor. Ind. Eng. Chem. *45*, 759-67 (Apr. 1953). Portland cement mortars prepared with a polyvinyl acetate to cement ratio of 0.2 show improvements in a number of useful properties. These include tensile and bond strengths, extensibility, and

DESIGN and PRODUCTION NEWS

FOR PLASTICS AND MATERIALS ENGINEERS

Published by TECHNICAL SERVICE, Chemical Manufacturing Division, The M. W. KELLOGG Company — OCTOBER 1953

Precision Connectors Use Kel-F to Provide Superior RF Insulation ...5,000v. Capacity...Cut Moisture Dissipation



Consistently high RF insulation and dimensional stability were prime requirements for the dielectric inserts in connectors required for an Atomic Energy installation. "Kel-F" plastic was found to be the material answering these and other "tough" requirements.

"Kel-F" maintains high RF insulation under conditions that cause other materials to fail. It is readily molded or machined to within .002″ of the critical dimensions required for the parts. And, because of its excellent wear characteristics, "Kel-F" maintains the precision of the critical insulators for a longer time. Frequent "connects", "disconnects" and operational vibration have negligible effect on the insulation because of the high strength—impact, compressive and flexural—of this fluorocarbon plastic. It takes rough handling without chipping, cracking or "freezing".

Exposure of the insulators made of "Kel-F" to high humidity fails to affect their dimensional stability or superior electrical properties. Zero water absorption and "nonstick" properties of this plastic reduce the need for maintenance by preventing the formation of fungus under high humidity or the accumulation of conductive residues.

The precision RF connectors illustrated are manufactured by the Dage Electric Company, Inc. of Beech Grove, Ind. for use in electronic equipment specified for nuclear studies. One of the insulating parts of "Kel-F" used is injection-molded for this company by the Brilhart Plastics Corporation of Mineola, N. Y. Another is machined from extruded Kel-F by Insulating Fabricators of New England, Inc., Watertown, Mass. The precision parts are then incorporated in special metal connector housings that are gold-plated.

Refer to Report E-115

Paper-Thin Diaphragms of Kel-F® Control Wet Chlorine Gas...Maintain Accuracy of New Chlorinator...Permit Continuous, Dependable Operation

Viciously hungry chlorine gas is kept in check in a new "corrosion-engineered" chlorinator by three diaphragms of the type illustrated. Made of unique "Kel-F" trifluorochloroethylene plastic, these diaphragms extend the troublefree life and increase the accuracy of the precision instrument used in sanitation systems and industrial processes. The chemically-inert fluorocarbon plastic remains unaffected indefinitely in constant contact with highly-corrosive wet and dry chlorine gas under vacuum. The excellent flexural and tensile properties of "Kel-F" prevent the continuously flexing diaphragms from developing fatigue cracks and failing in service. Countless flexing cycles will not cause work hardening, precluding any loss in sensitivity with rapid breakdown. Replacing corrosion-resistant metal diaphragms, "Kel-F" is more flexible over the required temperature range, permitting automatic control of gas flow rates within a fraction of a percent of the required setting.

These diaphragms of "Kel-F" plastic, approximately 9″ in diameter, are used in the "Ratochlor" chlorinator manufactured by Fischer & Porter Company of Hatboro, Pa.: in the instrument's differential pressure regulator, the vacuum regulator and the vacuum breaker. Made from type "A" Trithene* ("Kel-F" polymer) film supplied by The Visking Corporation, Terre Haute, Ind., each diaphragm consists of two sheets of 5 mil plastic. A circular bead is molded into each diaphragm face by the U. S. Gasket Company, Camden, N. J., for additional resiliency.

*The Visking Corporation's registered trade-mark

Refer to Report C-110

(SEE REVERSE SIDE)

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DESIGN and PRODUCTION NEWS

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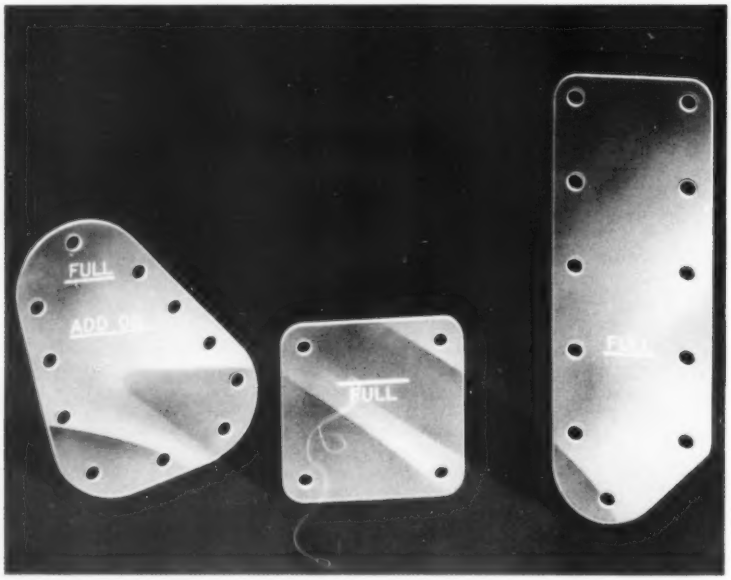

Shatter-Proof 'Copter Lube Glasses of Kel-F® Resist Corrosion and Aging...Stay Transparent ...Prevent Leaks Under Thermal Cycling, Vibration

Providing helicopter transmissions with oil sight glasses seemed to be an insoluble problem until "Kel-F" trifluorochloroethylene polymer plastic was tried. No other material could survive the severe corrosion, extreme temperatures, shock and vibration . . . and stay transparent indefinitely.

"Kel-F" was singled out for this application because of its unique combination of properties. The chemical inertness of this plastic at low and high temperatures prevents damage by oils, sludges and acids—from minus 65°F. to as high as 300°F. The exceptionally high compressive strength and resiliency of "Kel-F" in this temperature range permit mounting bolts to be pulled to leak tightness—without shattering or cracking the "glass". High impact strength protects the sight glass against external damage from tools, rough handling. And, in spite of these severe operating conditions, the "Kel-F" stays transparent!

Nichols Engineering, Inc. of Stratford, Conn. fabricates these sight glasses by molding sheets of "Kel-F" polymer up to ¼" thick, using a special technique to obtain perfect clarity. Standard machining methods and tools are then employed to true the edges, drill and countersink bolt holes and even to engrave the markings specified by the customer, a large manufacturer of civilian and military aircraft.

The excellent mechanical and chemical properties of "Kel-F" trifluorochloroethylene polymer allow these sight glasses to remain rigid and leak proof at all operating temperatures without developing brittleness and causing leaks of lubricant.

Refer to Report C-109

Remember "Kel-F" at The Chemical Show in November . . .

Interesting and unusual applications of "Kel-F" polymer plastics in the chemical industries will be displayed at the "Kel-F" Booth Nos. 835, 839 and 843 at the 24th EXPOSITION OF CHEMICAL INDUSTRIES, November 30th to December 5th, 1953. The place: Commercial Museum and Convention Hall, Philadelphia, Pa.

Molders of the Month

Leading molders and extruders specialize in fabrication of materials and parts made of Kel-F . . . each month this column will spotlight several of these companies with their principal services and products.

Cinch Manufacturing Corporation
Chicago, Ill.
Injection Molding
Electrical & Electronic Components
Tube Sockets & Connectors

Elastic Stop Nut Corporation of America
Union, N. J.
Injection Molding
Elastic Stop Nuts & Fasteners

Industrial Coatings Corporation
Chicago, Ill.
Dispersion Coating

Jet Specialties Company
Los Angeles, Calif.
Extrusion
Rod & Tube

Juno Tool Corporation
Minneapolis, Minn.
Compression & Transfer Molding
Injection Molding
Electrical & Electronic Components

Molding Corporation of America
Providence, R. I.
Compression & Transfer Molding
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Pump, Valve Diaphragms & Parts

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resistance to abrasion, impact, and corrosion. One of the outstanding results of this work is that the Portland cement mortars containing polyvinyl acetate show maximum improvement in properties when cured in air at ordinary temperatures and humidities. This is in contrast to plain cement mortars which require a water or damp curing to achieve optimum properties.

Properties

EFFECT OF HIGH ENERGY RADIATION ON SOME LONG-CHAIN POLYMERS. A. Charlesby. Plastics (London) *18*, 1 42-5 (May 1953). The effects of radiation on plastic materials are described. Polyethylene is considered in detail because of its simple chemical structure. Resultant changes in properties due to high energy radiation are: crosslinking of the molecules, increased chemical and swelling resistance, increased melting temperature, increased Young's modulus, reduced tensile creep, reduced tensile-failure elongation, and increased resistance to mineral acids. Radiation of polyethylene in air causes a surface oxidation but not internal oxidation. Some results are also given for polystyrene, nylon, polyvinyl alcohol, polyvinyl chloride, and rubber compounds. Polytetrafluoroethylene and polyisobutylene do not crosslink under radiation but instead, break down and decompose. A discussion of atomic reactions and radiation doses is given. Several other articles by the author in this field are listed.

LOW TEMPERATURE THERMAL EXPANSION OF PLASTICS. H. L. Lacquer and E. L. Head. Los Alamos Scientific Laboratory AECU-2161 (Sept. 1952). Dimensional changes at low temperatures of several plastics were measured. Some of these materials exhibit smaller and more reproducible contractions than others. The following, listed in order of increasing expansion, would seem most suitable for Cryogenic apparatus: glass reinforced polyesters, Araldite (an epoxy resin), fluorothene, polymethyl, methacrylate, and nylon.

FILMS FOR PRODUCE. H. A. Schomer. Modern Packaging *26*, 191-196 (Apr. 1953). Twenty-seven different plastics films were used to package 11 different vegetables. Results show that numerous films are satisfactory. Final choice of the correct film should be based on cost, transparency desired, tear strength, moisture permeability, and handability.

PYROLYSIS OF STYRENE, ACRYLATE, AND ISOPRENE POLYMERS IN A VACUUM. S. Straus and S. L. Madorsky. J. Research Nat. Bur. Standards *50*, 165-77 (Mar. 1953). Pyrolysis was carried out in a vacuum in the temperature range 250 to 400° C. The volatile products were collected and fractionated. The more volatile products were analyzed in the mass spectrometer, whereas the less volatile products were tested for their average molecular weights. In the styrene group of polymers, poly-alpha-methylstyrene yielded practically 100% of monomer, and poly-meta-methylstyrene and poly-alpha-deuterostyrene yielded about 52 and 70%, respectively, of monomer or other similar products, the other volatiles consisting of dimer, trimer, and some tetramer. Hydrogenated polystyrene yielded volatiles consisting of 6% of small molecules and a mixture of products of average molecular weight of 602. In the acrylate group of polymers, benzoyl peroxide polymerized polymethyl methacrylate, molecular weight 150,000, and thermally prepared polymethyl methacrylate, molecular weight 5,-100,000, yielded almost 100% of monomer. Polymethyl acrylate yielded carbon dioxide, methanol, and a mixture of various fragments, of average molecular weight of 686. In the isoprene group of polymers, synthetic polyisoprene, natural rubber (cis-polyisoprene), and gutta hydrocarbon (trans-polyisoprene), yielded isoprene, dipentene, and mixtures of large molecules of average molecular weight of about 600.

TRANSITIONS AND PHASES OF POLYTETRAFLUOROETHYLENE (TEFLON). C. E. Weir. J. Research Nat. Bur. Standards *50*, 95–7 (Feb. 1953). Transitions in polytetrafluoroethylene (Teflon) were studied as a function of pressure and temperature. A high-pressure transition (5,000 atm.) and a lower pressure transition were studied. These are believed to result from three polymorphic forms. The pressure of the high-pressure transition decreases and that of the low-pressure transition increases with increasing temperature. A triple point is indicated at approximately 70° C., and a third equilibrium line is found to proceed to higher pressures with increasing temperature from this point. Experimental errors involved render tests of all thermodynamic conditions at the triple point indeterminate.

STABILIZATION OF VINYL COMPOUNDS IN THEORY AND PRACTICE. C. P. Mack. Kunststoffe *43*, 94-101 (Mar. 1953). Several mechanisms are involved in the degradation of vinyl compounds. The primary reaction is the splitting off of HCl which is accelerated in the presence of oxygen and autocatalyzed by HCl. With the splitting of HCl, a conjugated polyene system develops which is subject to oxidation. Similarly to the oxidation of unsaturated fatty acids, carbonyl groups are formed and cross-linking follows at functional side groups. In the presence of heat, HCl splitting seems to be the predominant reaction. Considerable discoloration occurs but the mechanical properties decrease only slightly. In the presence of light, oxidation seems to be the main factor in the degradation. The mechanical properties are decreased and the material becomes brittle. The stabilizers which are used or are in the development state in the United States are described. Diagrams and color tables are given to show the effect of stabilizers on the properties of polyvinyl chloride. The principal stabilizers are organic compounds containing tin, lead, calcium, strontium and cadmium, alkali phosphates, epoxide, and chelate or other complex organic compounds.

Testing

DEFORMATION UNDER HEAT OF PLASTICS ACCORDING TO THE MARTENS METHOD. C. M. von Meysenbug. Kunststoffe *43*, 214-220 (June 1953). Several methods are known to determine the deformation of plastics under simultaneous exposure to thermal and mechanical stresses. The Martens method which is used in Germany is investigated. A testing instrument is described and data are given for tests with phenolic, styrene and polyvinyl chloride plastics.

METHODS OF DETERMINING COMPRESSION SET OF ELASTOMERS AT LOW TEMPERATURES. J. I. Belfer. ASTM Bulletin *1953*, No. 190, 43-45 (May 1953). A quick-acting wrench test method for determining the compression-set of elastomeric materials at low temperatures is described.

U. S. PLASTICS PATENTS

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 25¢ each.

RESINS. J. T. Thurston (to American Cyanamid). U.S. 2,640,046-7, May 26. Condensates of an aldehyde, a polyhalogenated compound and a triazine derivative.

RESIN. J. S. Beekly (to du Pont). U.S. 2,640,048, May 26. Chlorosulfonation of polyethylene with azo catalysts.

COPOLYMERS. G. M. Rothrock (to du Pont). U.S. 2,640,049, May 26. Preparation of acrylonitrile-vinyl pyridene copolymers.

COPOLYMERS. W. J. LeFebre and H. W. Moll (to Dow). U.S. 2,640,050, May 26. Copolymerization of vinylidene chloride and vinyl chloride.

LENSES. J. Johnson (to Combined Optical Industries). U.S. 2,640,227, June 2. Production of lenses from transparent plastics.

INK. H. S. Bloch and A. E. Hoffman (to Universal Oil Products). U.S. 2,640,782, June 2. Printing ink containing a polymerized olefin.

CELLULOSE ESTERS. J. K. Craver (to Monsanto). U.S. 2,640,785, June 2. Alpha phenyl-2-ethylcyclohexanol as stabilizer for cellulose esters.

SEALING. N. Langer. U.S. 2,640,796, June 2. Heat-sealing of thermoplastic sheets.

REINFORCED WEB. C. G. Evans and P. H. H. Bishop (to Government of Great Britain). U.S. 2,640,797, June 2. Web of asbestos impregnated with resin.

SEALING. N. Langer. U.S. 2,640,798, June 7. Heat sealing layers of thermoplastic material.

LAMINATING. D. H. Grangaard (to Paper Patents). U.S. 2,640,799, June 2. Continuous laminating process.

RESIN. A. F. Schmutzler (to American Cyanamid). U.S. 2,640,814, June 2. Tall oil-polyamino-aldehyde reaction product.

RESINS. R. R. Whetstone and S. A. Ballard (to Shell). U.S. 2,640,815, June 2. Resins from dihydropyran derivatives.

VINYL RESINS. L. M. Germain (to Shawinigan). U.S. 2,640,816, June 2. Solutions of polyvinyl alcohol-acetate.

ANTISTATIC COATINGS. E. G. Sheridan, L. L. Yaeger, and J. Bjorksten (to Nash-Kelvinator). U.S. 2,640,-817, June 2. Antistatic coatings for plastics.

SILOXANES. P. A. Di Giorgio (to General Electric). U.S. 2,640,818, June 2. Thienyl-substituted polysiloxanes.

POLYMERIZATION. G. R. Barrett (to Monsanto). U.S. 2,640,819, June 2. Polymerization of styrene and maleic derivatives.

RESINS. A. S. Teot and G. C. Wiggins (to Dow). U.S. 2,640,820, June 2. Water-soluble resin sulfonates.

POLYAMINES. D. Harman and H. J. Sommer (to Shell). U.S. 2,640,822, June 2. Acylated oxygen-containing polyamines.

ARMORED GARMENT. R. W. Ehlers (to United States). U. S. 2,640,987, June 9. Armored garment of layers of plastic fibers spot-laminated together with resin.

FILM. R. C. Kress (to Extruders). U. S. 2,641,022, June 9. Manufacturing plastic film.

CUTTING MACHINE. J. J. Gano (to J. Orbell). U. S. 2,641,041, June 9. Device for cutting and piercing a column of extruded plastic.

CUTTING MACHINE. P. E. Kopp. U. S. 2,641,042, June 9. Cutting machine for extruded plastics.

HEAT SEALING. V. M. Morrell (to du Pont). U. S. 2,641,166, June 9. Continuous heat-sealing apparatus.

INTERPOLYMERS. D. W. Chaney and H. G. Sommar (to American Viscose). U. S. 2,641,524, June 9. Acrylonitrile vinyl amine interpolymers.

PHOTOPOLYMERIZATION. C. C. Sachs and J. Bond (to Alexander H. Kerr). U. S. 2,641,576, June 9. Photopolymerization of an olefinic material and a halogenated mono ketaldonyl.

ADHESIVE. T. A. Martone, Jr. (to du Pont). U. S. 2,641,584, June 9. Adhesive composition of starch, an amine, and a urea-formaldehyde resin.

FIBERS. *G. E. Ham* (to Shemstrand). U. S. 2,641,585, June 9. Polyacrylonitrile dissolved in dimethyl phosphite.

THIXOTROPIC COMPOSITIONS. B. W. Nordlander, J. A. Loritsch, and R. E. Burnett to General Electric). U. S. 2,641,586-7, June 9. Unsaturated alkyd resins and clay fillers.

STABILIZERS. W. E. Leistner and O. H. Knoepke (to Argus Chemical Laboratory). U. S. 2,641,588, June 9. Organo-tin stabilizers for halogenated resins.

SILOXANES. P. J. Chevalier (to Societe des Usines Chimiques Rhone-Poulenc). U. S. 2,641,589, June 9. Fluid methyl polysiloxanes.

COPOLYMERS. E. L. Little, Jr. (to du Pont). U. S. 2,641,590, June 9. Carbon monoxide-olefin copolymers.

RESINS. D. M. Gagarine (to Dan River Mills). U. S. 2,641,591, June 9. Acetone-formaldehyde resins.

RESIN. C. H. Hofrichter, Jr. (to du Pont). U. S. 2,641,592, June 9. Polyethylene-terephthalate produced with cobaltous acetate catalyst.

RESINS. H. M. Teeter and J. C. Cowan (to United States). U. S. 2,641,593, June 9. Polyamide resins.

RESINS. A. L. Barney (to du Pont). U. S. 2,641,594, June 9. Polymers of vinylidene bis (hydrocarbon sulfones).

POLYMERS. R. F. Leary (to Standard Oil). U. S. 2,641,595, June 9. Copolymers of isobutylene and styrene.

POLYMERS. E. C. Britton and P. S. Petrie (to Dow). U. S. 2,641,614, June 9. Condensates of styrene oxide with alkylene oxides.

POLYISOBUTYLENE. J. R. Quelly and S. A. Sankus (to Standard Oil). U. S. 2,641,620, June 9. Low polymers of isobutylene.

WORKING. H. A. Myers (to Western

(*Continued on p. 164*)

In Extrusion Equipment

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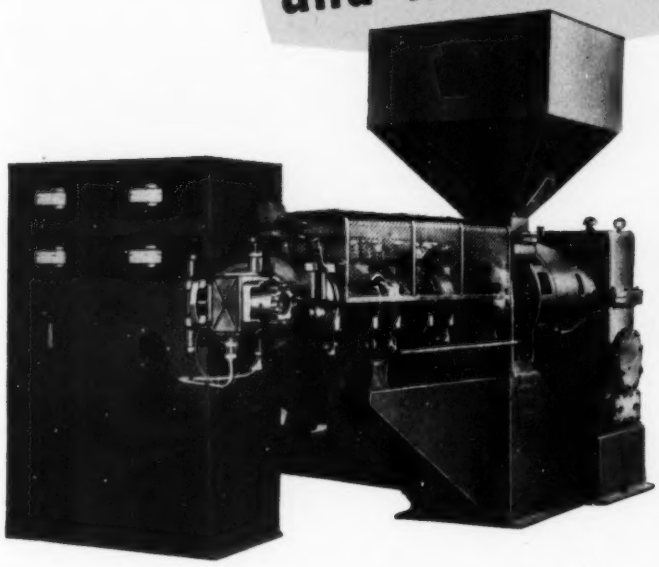

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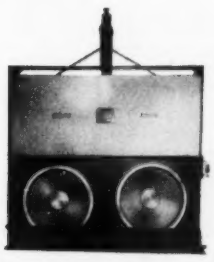

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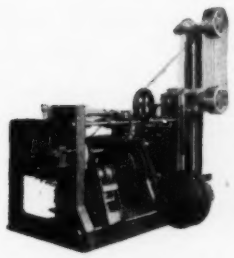

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Tricresyl Phosphate, Petroleum Base—combines excellent solvent power and flame retardant properties as general plasticizer for vinyl resins and cellulosic plastics. Especially advantageous for coatings and films where extreme flame resistance and toughness are vital. Gasoline and oil additive.

CELLUFLEX* 112
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Triphenyl Phosphate—most widely used plasticizer in cellulose acetate. Provides excellent fire resistant properties, good flexibility; produces clear tough compositions.

CELLUFLEX* DBP
Dibutyl Phthalate—excellent light and heat stability, low viscosity plasticizer. Most widely used plasticizer for cellulose nitrate lacquers and coatings. Produces good gloss, high flexibility.

CELLUFLEX* DOP
Dioctyl Phthalate—low volatility, excellent heat and light stability, superior electrical properties. Primary plasticizer for vinyl resins, synthetic rubber in cloth coatings, elastomeric molded materials.

DESCRIPTIVE DATA

CELANESE PLASTICIZER	GRADE	APPEARANCE	COLOR APHA Max.	SPECIFIC GRAVITY @ 20/20°C.	ACIDITY	ESTER VALUE % Min.	PERMANGANATE TIME, Min. (in Minutes)	REFRACTIVE INDEX $n_D^{25°C.}$
LINDOL* tricresyl phosphate coal tar base	Technical	Clear transparent liquid	75	1.165 ± .005	0.01 (3)	99	30	1.553
CELLUFLEX* 179C tricresyl phosphate petroleum base	Technical	Clear transparent liquid	150	1.165 ± .005	0.01 (3)	99	30	1.553
CELLUFLEX* 112 a mixed ester	Technical	Clear transparent liquid	40	1.210 ± .005	0.01 (3)	99	30	1.560
CELLUFLEX* TPP triphenyl phosphate	Technical	White flakes	20	—	0.003 (3)	99	30	1.550 (1)
CELLUFLEX* DBP dibutyl phthalate	Technical	Clear transparent liquid	50	1.045 ± .001	0.01 (2)	98	—	1.490
CELLUFLEX* DOP dioctyl phthalate	Technical	Clear transparent liquid	50	0.986 ± .002	0.01 (2)	98	—	1.485

(1) @ 60°C. (2) % as phthalic, max. (3) % as phospheric, max.

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ACETIC ACID (GLACIAL)

ACETIC ANHYDRIDE

BUTYRIC ACID

FORMALDEHYDE (FORMALIN)

FORMCEL* SOLUTIONS

PARAFORMALDEHYDE

P. E. (PENTAERYTHRITOL)

PROPIONIC ACID

VINYL ACETATE MONOMER

ACETIC ACID—reactant and solvent in manufacture of cellulose acetate.

ACETIC ANHYDRIDE—acetylating agent used primarily for the esterification of cellulose to cellulose acetate.

BUTYRIC ACID—used in manufacture of cellulose acetate-butyrates for molded products, lacquers, weatherproof coatings.

FORMALDEHYDE (FORMALIN)—reacts with phenol, urea and melamine to form plastics and resinous products.

FORMCEL* SOLUTIONS—relatively water-free formaldehyde solutions in selected alcohols. Starting materials for production of alcoholated condensation resins.

PARAFORMALDEHYDE—Low water content formaldehyde (91% assay as formaldehyde) in solid ferm, used in production of urea and phenolic resins for greater efficiency in cycle time, yield and production costs.

P. E. (PENTAERYTHRITOL)—used in manufacture of medium and long oil alkyd resins, to produce surface coatings with higher gloss retention, faster drying time, increased durability. Also used in production of rosin esters and synthetic drying oils.

PROPIONIC ACID—used for production of cellulose propionate, a molding powder exhibiting superior impact strength and aging characteristics.

VINYL ACETATE MONOMER—basic material in manufacture of polyvinyl resin adhesives, textile and paper coatings, plastic films, sheeting and molding materials, water-emulsion paints.

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NORMAL BUTANOL
ISOBUTANOL
NORMAL BUTYL ACETATE
NORMAL PROPANOL
NORMAL PROPYL ACETATE
PROPYLENE GLYCOL

ACETONE—solvent for cellulose acetate, cellulose nitrate, oils, gums, fats.

NORMAL BUTANOL—latent solvent for cellulose ester lacquers, dopes, thinners, urea-formaldehyde resins.

ISOBUTANOL—modifying agent in alcoholated ureas.

NORMAL BUTYL ACETATE—widely used medium evaporating solvent in lacquers.

NORMAL PROPANOL—excellent ethyl cellulose solvent. Latent nitrocellulose solvent with same evaporation rate as butyl acetate.

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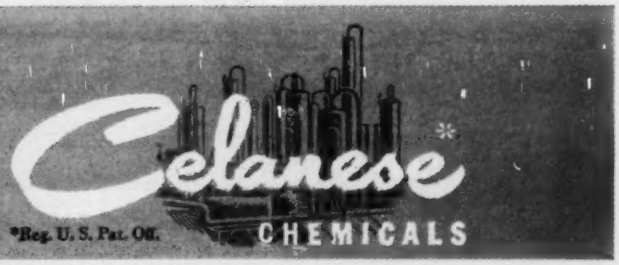

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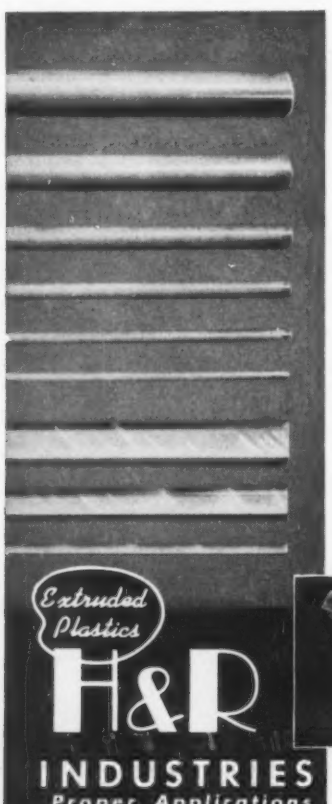

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. . . Product Improvement

Electric). U. S. 2,641,800, June 16. Device for advancing and working plastics.

FRICTION MATERIALS. C. S. Batchelor and H. J. Cofek (to Raybestos). U. S. 2,641,801, June 16. Heat hardening friction materials.

DENTURE. S. J. Infante (to P. B. Molinaro). U. S. 2,641,837, June 16. Plastic tooth mounting.

MOLDING. A. W. Sizer. U. S. 2,642,-011, June 16. Machine for extruding plastic pellets.

LAMINATES. G. B. Parsons and D. D. Wyandanch (to Fairchild Engine). U. S. 2,642,370, June 16. Multiply polyethylene-fabric laminates.

ORNAMENTATION. J. Garofano. U. S. 2,642,390, June 16. Metallic ornamentation on plastics.

POLYMERIZATION. E. S. Corner and C. S. Lynch (to Standard Oil). U .S. 2,642,402, June 16. Olefin polymerization with phosphoric acid deposited on silica gel as catalyst.

CELLULAR PLASTICS. E. Simon and F. W. Thomas (to Lockheed Aircraft). U. S. 2,642,403, June 16. Foam product containing saturated and unsaturated polyester resins.

COATING. M. L. Nielsen (to Monsanto). U. S. 2,642,405, June 16. Nitrogen-Phosphorous compounds in amine-aldehyde resins.

ACRYLONITRILE. J. B. Dickey, T. E. Stanin, and H. W. Coover, Jr. (to Eastman Kodak). U. S. 2,642,406 June 16. Solutions of copolymers of acrylonitrile in organicphosphorous compounds.

VINYL RESINS. P. F. Bruins, E. P. Wilkinson, and E. P. Rittershousen (to Socony-Vacuum). U. S. 2,642,-407, June 16. Vinyl resins plasticized with esterified aromatic hydrocarbons.

ACRYLONITRILE. T. E. Stanin, J. B. Dickey and H. W. Coover (to Eastman Kodak). U. S. 2,642,408, June 16. Stabilized solutions of acrylonitrile polymers and copolymers.

RESINS. D. E. Cordier (to Libbey-Owens-Ford). U. S. 2,642,409, June 16. Moldable compositions of unsaturated alkyd resin and kaolin coated with heterocyclic amine-aldehyde resin.

POLYMERIZATION. H. A. Hoppens (to Libbey-Owens-Ford). U. S.

2,642,410, June 16. Polymerization in the presence of an organic hydroperoxide and a metal salt drier.

POLYSILOXANES. P. J. Chevalier (to Societe des Usines Chimiques Rhone-Poulenc). U. S. 2,642,411, June 16. Polymethyl siloxanes.

RESINS. H. A. Newey and E. C. Shokal (to Shell). U. S. 2,642,412, June 16. Curing glycidyl polyethers with N,N-dialkyl-1, 3-propane-diamines.

POLYMERS. H. W. Coover, Jr. (to Eastman Kodak). U. S. 2,642,413, June 16. Polymers of phosphonic acid diamides with ureas.

COPOLYMERS. L. N. Bauer, H. T. Neher, and W. L. Van Horne (to Rohm and Haas). U. S. 2,642,414, June 16. Copolymers of maleic esters and long chain alkyl methacrylates.

POLYMERS. A. H. Ahlbrecht, T. S. Reid, and D. R. Husted (to Minnesota Mining). U. S. 2,642,416, June 16. Fluorinated acrylate polymers.

ION EXCHANGE. R. M. Wheaton and D. F. Harrington (to Dow). U. S. 2,642,417, June 16. Vinyl resin ion exchange material.

ACRYLONITRILE. H. Wenning (to Chemische Werke Huls). U. S. 2,642,-418, June 16. Polyacrylonitrile production.

POLYVINYL ALCOHOL. G. P. Waugh, E. W. Taylor, and W. O. Kenyon (to Eastman Kodak). U. S. 2,642,419-20, June 16. Production of polyvinyl alcohol.

RESINS. M. G. Morningstar, C. S. Schollenberger, and G. E. Stueber (to B. F. Goodrich). U. S. 2,642,449, June 16. Preparation of polyisocyanates.

MOLDING, G. S. Bohannon (to Crown Machine and Tool). U. S. 2,-642,623, June 23. Plasticizer unit for injection molding machine.

FILMS. D. B. Peck (to Sprague Electric). U. S. 2,642,625, June 23. Production of thin films of polytetrafluoroethylene.

HEATING PREFORMS. J. W. Mann and G. F. Russell. U. S. 2,642,627, June 23. Preheating a thermosetting resin preform with radio-frequency energy.

JIG. E. Janowski. U. S. 2,642,918, June 23. Jig for holding a plurality

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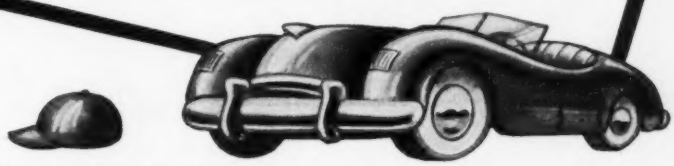

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BRUSHES. N. T. Baldanza (to Columbia Protektosite). U. S. 2,643,158, June 23. Molding thermoplastic brushes.

FIBERBOARD. M. C. Fugua (to Standard Oil). U. S. 2,643,200, June 23. Treating fiberboard with a partially cured olefinic polymer oil.

FILM. D. R. Burton and H. W. Wilson (to Wingfoot). U. S. 2,643,-202, June 23. Non-blocking rubber hydrochloride film.

COATING. W. B. Hughes and B. Heinze (to Cities Service). U. S. 2,643,227, June 23. Treating metal with the reaction product of polyethylene amine and an aldehyde.

POLYMERS. F. L. Rose and G. Swain (to Imperial Chemical) U. S. 2,643, 232, June 23. Polymeric diguanides.

RESINS. E. L. Kropa and W. M. Thomas (to American Cyanamid) U. S. 2,643,236, June 23. Condensates of pentaerythritol and glyoxal.

RESINS. J. F. Howe and J. E. Wicklatz (to Phillips Petroleum). U. S. 2,643,237, June 23. Imides as stabilizers for polysulfone resins.

ADHESIVE. R. N. Crozier and W. K. Wilson (to Shawinigan Resins). U. S. 2,643,238, June 23. Adhesive of vinyl ester.

RESINS. E. C. Shokal. H. A. Newey, and R. F. Bradley (to Shell Development). U. S. 2,643,239, June 23. Nitrogen-containing polyethers and process for curing glycidyl polyethers.

POLYSULFONES. W. W. Crouch and J. F. Howe (to Phillips Petroleum). U. S. 2,643,241, June 23. Stabilizing polysulfone resins with organic sulfides.

RESINS. J. W. Churchill (to Mathieson). U. S. 2,643,242, June 23. Polydichlorostyrene containing organotin anticrazing agents.

RESINS. H. Dannenberg (to Shell Development). U. S. 2,643,243, June 23. Curing glycidyl polyethers of dihydric phenols with sulfonic acids.

RESINS. J. K. Simons (to Libbey-Owens-Ford). U. S. 2,643,244, June 23. Epichlorhydrin-sulfonamide resins.

COPOLYMERS. W. K. Wilson (to Shawinigan Resins). U. S. 2,643,-

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PERFORATING OF PLASTICS. Folder contains sample swatches of films, rigid sheets, and coated plastics perforated with various sizes and spacing of holes for ventilation, air escape, light transmission, and decorative applications. The Harrington & King Perforating Co. **(J-309)**

PLASTISOLS AND PLASTICIZERS. Catalog gives specifications of the RC ester-type plasticizers used in films and sheetings, extrusions, molded objects, and coatings. Performance data on dripping, molding and casting plastisols for coating fabrics, dip coating of metal parts, and slush molding, also included. Rubber Corp of America. **(J-316)**

MOLDING GLASS-FIBER REINFORCED ALKYDS. Bulletin contains latest available information on transfer and compression molding techniques for use with Plaskon 440 glass-fiber reinforced alkyd molding compound. Plaskon Div., Libbey-Owens-Ford Glass Co. **(J-325)**

TESTING INSTRUMENTS. Testing instruments for weight, determining bulk or thickness, and bursting strength of plastic, metal, fabric, paper, rubber, foil, glass, etc., are described and illustrated in a pamphlet issued by E. J. Cady & Co. **(J-327)**

USE OF PASTE COLORS WITH POLYESTER RESINS. Pamphlet on the development, uses, and advantages of paste colors for polyester formulas contains details on the mixtures of organic and inorganic compounds necessary to produce various shades. Ferro Corp. **(J-332)**

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245-6, June 23. Copolymers of monoalkyl esters of maleic acid.

ELASTOMER. C. H. Fisher and W. C. Mast (to United States). U. S. 2,643,-247, June 23. Copolymers of alkyl acrylates and aliphatic dienes.

EMBOSSED PANELS. K. F. Smith (to Neon Products). U. S. 2,643,417, June 30. Embossed thermoplastic sheet.

LURE. D. D. Auldridge (to A. S. Tennant). U. S. 2,643,418, June 30. Fishing lure embedded in thermoplastic resin.

CYLINDERS. G. G. Havens (to Marmco). U. S. 2,643,700, June 30. Process for forming resin-impregnated fabric cylinders.

ACRYLONITRILE. R. A. Scheiderbauer (to du Pont). U. S. 2,643,934, June 30. Stabilizing polyacrylonitrile articles by bleaching followed by treating with hypophosphorous acid.

ADHESIVE. W. Schoen (to Masonite). U. S. 2,643,953, June 30. Hydrolyzed lignocellular adhesive.

PLASTICIZERS. J. R. Caldwell (to Eastman Kodak). U. S. 2,643,954, June 30. Alkoxyalkyl esters of bis (4-carboxyphenyl) sulfone as plasticizers for cellulose esters.

FLAME SPRAYING. J. B. Powers and R. E. Bludean (to Carbide and Carbon). U. S. 2,643,955, June 30. Apparatus for flame-spraying polyethylene.

ADHESION. R. Smith-Johannsen (to General Electric). U. S. 2,643,964, June 30. Improving adhesion of polysiloxanes to solid surfaces.

COATING. E. G. B. Riley. U. S. 2,643,982, June 30. Light-absorbent vinyl resin coating.

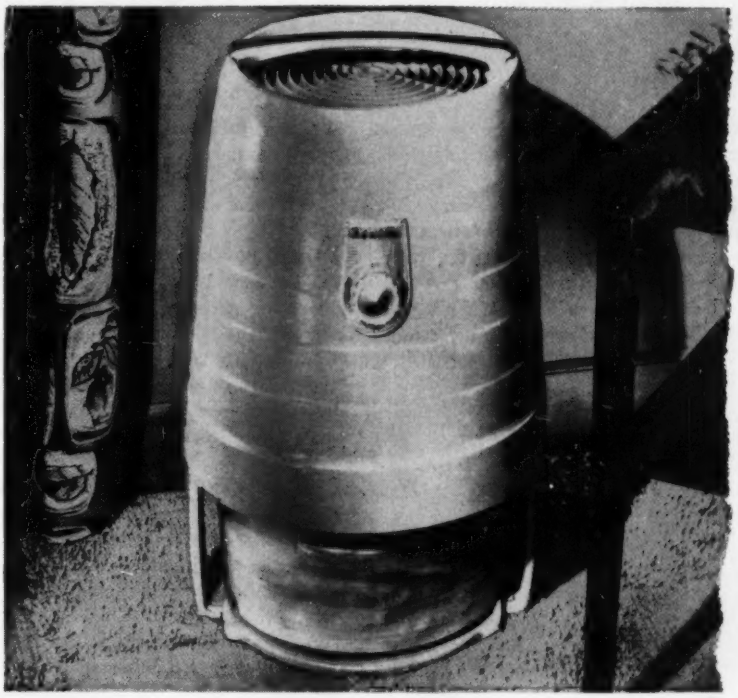
MOLDED PRODUCTS. C. Dangelmajer (to Emsig). U. S. 2,643,983, June 30. Moldable polyester resin.

AMINOPLASTS. T. Boyd (to Monsanto). U. S. 2,643,984, June 30. Aminoplasts modified with titanium polymers.

STABILIZERS. E. E. Parker (to Pittsburgh Plate Glass). U. S. 2,643,985, June 30. Stabilizing unsaturated polyesters with phenyl substituted catecholds.

FIBERS. G. E. Ham and A. B. Draig (to Chemstrand). U. S. 2,643,986, June 30. Fiber-forming polymers reacted with tris (dimethylamido) phosphite.

Perfection in Plastics



HOUSING and LEG SUPPORTS for the new Admiral Moisture Conditioners molded by SINKO . . . of Koppers MC-309 High Impact Polystyrene

Exceedingly attractive . . . grained to resemble wood . . . a fitting complement to the most richly furnished living room.

And in addition to good looks, both the housing and leg supports offer maximum resistance to impact, moisture, and heat; highly important requirements in an appliance such as this.

You'll find the SINKO name synonymous with Perfection in Plastics . . . that is why we are today serving many leading manufacturers such as Admiral on their needs in molded plastics.

We mold all Thermoplastics including Nylon, in sizes from 4 to 60 ounce; and have the experience and know-how to offer you expert guidance on your particular requirements.

Contact us just as soon as you have a molding problem . . . we welcome your inquiries!

Sinko

SINKO MFG. & TOOL CO.
3135 WEST GRAND AVE. • CHICAGO 22, ILLINOIS

BRANCH OFFICES:

HADDONFIELD, N. J.
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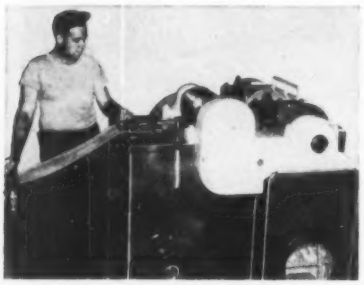
RICHARD P. VALLEE—2302 W. Clybourn St.

MARION, IND.
SAUL GANZ—4th & Branson St.

NEW MACHINERY AND EQUIPMENT

CUBER—Designed for use by large producers of compounded plastics, a heavy-duty plastics cuber for cutting plastics materials with or without pigment loading has been made available by Hale & Kullgren, Inc., P.O. Box 1231, Akron, Ohio.

The unit has a rated capacity of 3300 lb. of cubed stock per hr., using



Hale & Kullgren's heavy-duty cuber has capacity of 3300 lb. per hr. with 8 in. wide and ⅛ in. thick strip

a strip about 8 in. wide and ⅛ in. thick, and can be adapted for strips wider than 8 inches.

Cubes are cut to uniform size, and the cutting operation does not cause any rise of temperature in the stock. Heavy-duty mountings absorb most of the vibration and thus reduce noise. Setting of knives has been designed to keep resharpening maintenance to a minimum.

MARKER—For freehand electrical marking on all steels, alloy steels, ferrous alloys and casts, and wrought iron, a portable electric marker has been designed by H. P. Preis Engraving Machine Co., 192 Industrial Branch, Hillside, N.J.

Available in two models (EM-60, standard, 500 w.; and EM-120, heavy duty, 1000 w.), the units are equipped with a 10-position rotary switch which the operator can adjust to control the intensity of the marking. This feature is particularly important when marking gage blocks, precision dies, and other parts which may be easily damaged.

The marking pencil is attached to a cork-insulated, hollow, ventilated sleeve.

Over-all sizes of the units are 8¼ in. wide by 10 in. high by 5 in. deep for Model EM-60 and 6¼ in. deep for the heavy-duty instrument. Weights are 20 and 30 lb. respectively. Both models are designed to operate from a 50- to 60-cycle, 155- or 230-v. a.-c. line.

EXTRUDER AND ACCESSORIES—Three pieces of extruding and associated equipment have recently been introduced by Projectile & Engineering Co. Ltd., Acre St., Battersea, London, S.W. 8, England.

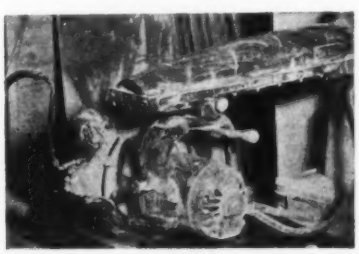
A 2½-in. extruder features alternative screws available as standard equipment, for a range of thermoplastics, a barrel whose length is adjustable by the addition or removal of sections, a variable speed motor, controlling and indicating pyrometers for each zone, and alternative forms of die attachments.

The die head is designed so that two methods of die attachment are possible, either by split clamp or by direct bolting to extruder flange. The barrel section flanges are all of small diameter and are circular so that band heaters may be used with them if local heat losses make this necessary.

The Model 1 combined roller and conveyor take-off unit is capable of handling almost any extruded section. The equipment consists of three units—main pedestal, drive, and conveyor. The main pedestal and drive housing is situated on a large base for maximum stability. The pedestal height is adjustable to the operating height of the extruder. The conveyor is a self-contained unit, except for the motive power which is derived from the main pedestal. A water tank is located in the central drive housing to cool the belt. The belt, heat-, water-, and acid-resistant, is of the continuous type, 6 in. wide and 12 ft. long. A gripping roller at the far end of the belt provides additional grip where necessary. The entire unit may be transported with ease on four casters.

Series D material drier provides for drying and preheating of all hygroscopic molding materials. The drier consists of two parts—the hopper and the heater unit. The hopper is designed to subject the plastics material to an even distribution of heated air. The distribution cone is easily removed for cleaning. The heater unit has a dry type, cleanable air filter, a high-pressure centrifugal fan and motor, a 3 kw. heater, and an electric control panel. A variable transformer allows a heat input range of 0 to 3 kilowatts. An indicating thermometer is fitted around the hopper base, and the heaters are adjustable to give the required temperature in this area.

ABRASIVE BLADE—Particularly adaptable to the production cutting of fibrous glass reinforced plastics, the CBR circular saw blade produced by Clipper Mfg. Co., 2800 Warwick, Kansas City, Mo., is available in sizes of 6- to 18-in. diameter. These blades are claimed by the manufacturer to be capable of withstanding

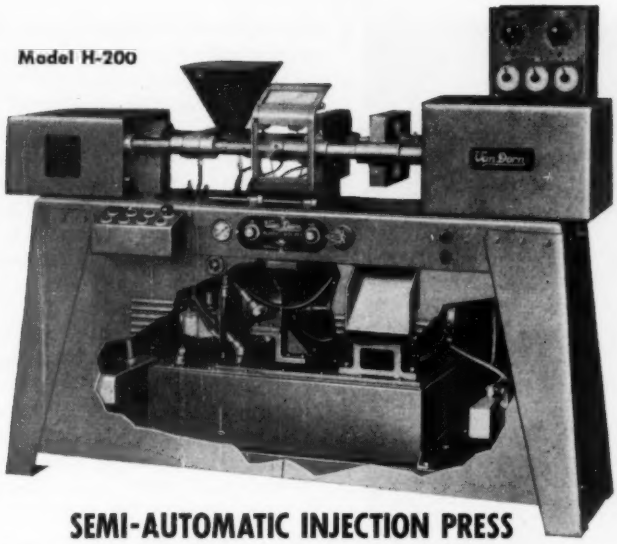


Clipper's CBR circular saw blades are adaptable to the production cutting of fibrous glass reinforced plastics

the bending and twisting stresses sometimes encountered in such operations. For best cooling results, prevention of "loading," and elimination of dust, directing a stream of water against the blade edge as it enters the work is suggested.

AUXILIARY PELLETIZER—A new pelletizing unit has been developed by F. J. Stokes Machine Co., 5500 Tabor Rd., Philadelphia 20, Pa., for use in conjunction with its Stokes-Wind-

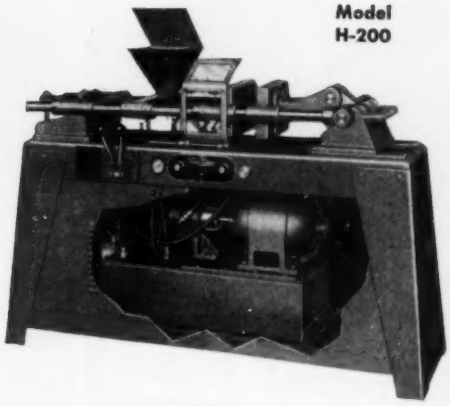
Model H-200



SEMI-AUTOMATIC INJECTION PRESS

2-oz. capacity. Van Dorn's engineering experience has scored again with this leader among all injection presses of its class. Its ultra-modern design insures faster operating cycles—up to 6 per minute. Push button controls are safe, simple and convenient. Accurate temperature regulation. Ruggedly built, compact and quiet.

Model H-200



Power Operated, Lever Controlled Presses—Available in 2-oz. or 1-oz. models. These profit-makers feature: Rugged all-welded construction; built-in safety devices; heating chamber with ample plasticizing capacity.

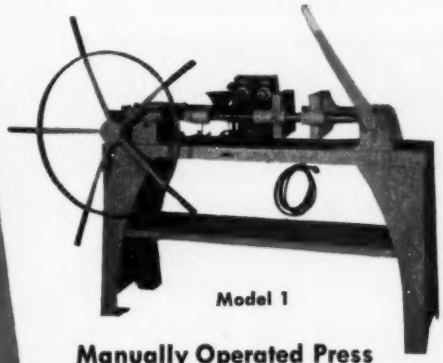
VAN DORN
Plastic Equipment

COSTS LESS to Buy...to Operate!

Van Dorn presses are *unexcelled in efficiency* and *unequalled in economy* on the innumerable jobs where a 2-oz. injection is ample. Costwise, Van Dorn presses are outstanding for these reasons:

1. **Surprisingly low in price**
2. **Operate 8 hours for a few dollars**
3. **Use less expensive molds**
4. **Easily set up by one man in a few minutes**

These presses mold practically all thermoplastics including nylon . . . Look over the Van Dorn presses and plastic equipment shown—*then write for detailed Bulletins on individual machines.*

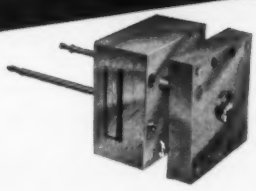


Model 1

Manually Operated Press
1-oz. capacity. Ideal for smaller jobs, experimental work, training.

Plastic Grinder
Grinds up rejects, waste, etc., for re-use. Ruggedly made, easily cleaned.

Model G-100



Mold Bases
. . . Available from stock for all Van Dorn presses.

THE Van Dorn IRON WORKS CO.
2687 EAST 79th STREET • CLEVELAND 4, OHIO
Cable Address: "VANDORN" Cleveland

Keep Odor at a Minimum

in Processing and in Finished Product

the odorless dialkyl phthalate

STAFLEX® MP

A quality upgrading replacement for dioctyl phthalate

Reduces Processing Loss

STAFLEX MP has exceptionally low volatility. The resultant decrease in fuming during processing can save you about ½ cent per pound of plasticizer.

Typical Results in Plastisols

Age	Viscosity DOP	Viscosity STAFLEX MP
0 days	5,000	3,800
30 days	8,700	5,000
90 days	11,400	6,000

Other Benefits

1. Improves water, soap and age resistance.
2. Allows longer storage of plastisols.
3. Low specific gravity.

Available in Drums and Tanks

Write for STAFLEX MP Technical Bulletin and Samples.

DEECY PRODUCTS CO.
PLASTICIZERS STABILIZERS
120 Putter St., Cambridge 42, Mass.

Stokes' auxiliary pelletizing unit, used with its Series RC-100 extruders, eases molders' inventory requirements

sor extruders. The combination makes possible single-pass compounding, coloring, and pelletizing, and is of particular interest to large injection molders who can use it for all their preparatory work, thus confining their material inventory to neutral plastics raw materials.

The set-up is simple to operate and virtually automatic. The extruder hopper is loaded with the plastics material to be extruded—which may be polystyrene, polyethylene, butyrate, cellulose acetate, methacrylate, or elastomeric vinyl—and the required coloring mix. As the material is extruded, the strands dip immediately into a cooling water tank and, after cooling and hardening, pass over a series of air jets placed transversely across their path to remove all moisture, through a set of variable-speed drawings rolls into a chopper. There they are cut into small, roughly cubical pieces of the desired size.

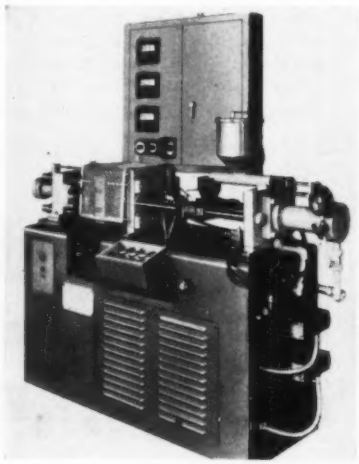
The company states that tests conducted on the combination showed production rates of 170 lb. per hr. compounding and coloring polystyrene material, using a screen pack of 180-mesh.

MARKING—Particularly applicable to the roll leaf marking of molded thermosetting parts is a new stamping press which uses silicone blanking dies, introduced by the Olsenmark Corp., 132 White St., New York 13, N.Y.

The usual process of hot stamping consists of embossing a molded part using a brass or steel die under heat and pressure, color being simultaneously transferred from a stamping foil into the embossed area. In the silicone die method, the desired design is molded as a raised surface on the plastics part. A flat sheet of silicone rubber is mounted on the head of the roll leaf stamping press. This die, because it is flexible, will apply an even coating of colorant when the heated silicone surface comes into contact with the raised design, even on uneven surfaces.

INJECTION MOLDING MACHINE—Built along lines of larger horizontal units, Model 72, 2-oz. injection molding machine is especially intended for small part production of plastics products where mold cost is a prime consideration.

The equipment, manufactured by Moslo Machinery Co., 2443 Prospect Ave., Cleveland 15, Ohio, has the company's Radee Material cylinder of stainless or nickel steel and a special 4-point toggle clamp with calibrated adjusting nuts. The machine operates at 525 cycles per hr.,



Moslo's Model 72 horizontal injection molding machine has 4-point toggle clamp with calibrated adjusting nuts

dry run, can be operated manually, semi-automatically, or fully automatically, and comes equipped with standard 5-hp. 1800-r.p.m. 220/440/550/3/60 motor and starter, and 220-v. heater. Motor and hydraulic equipment are fully enclosed. Standard 8- by 9-in. DME mold blanks and others can be installed on the machine.

TEMPERATURE CONTROL—Delivery of water at closely controlled temperatures to molding machines and reduction in the amount of water used are features of the Aero Heat Exchanger produced by Niagara Blower Co., 405 Lexington Ave., New York 17, N.Y.

The equipment employs the evap-

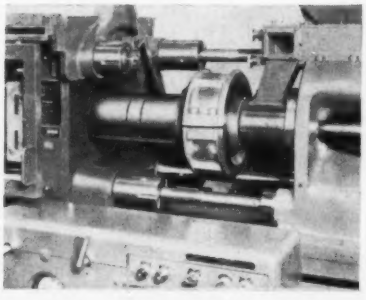
orative principle for cooling the water circulated through molding machines. A wet bulb control system, built into the exchanger, controls the temperature of the recirculated water and prevents freezing during winter operation. Generally, water is delivered in a temperature range of 60 to 70° F., except for peak summer temperatures when it may reach a maximum of 80° F.

The unit uses air as a cooling medium by evaporating a water spray which transfers 1000 B.T.U. to the air per lb. of water used. Circulating water is confined within a closed coil circuit so that it is not subject to contamination from contact with outside air.

VALVE—A solenoid operated air valve designed by Mechanical Air Controls, Inc. 15311 W. 11 Mile Rd., Detroit 37, Mich., has an aluminum alloy surface-hardened spool on which the sealing material is molded and bonded. These seals enter the bores of body and retainers to effect instantaneously positive "sealed with air pressure" seals. Valve has full pipe orifice area with maximum of straight-through flow.

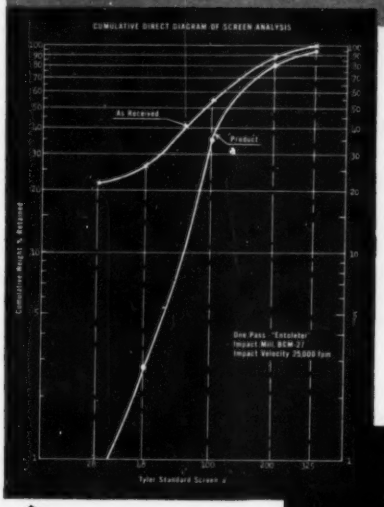
REPLACEMENT CYLINDER—Greater plasticizing capacity is claimed for a replacement 8-oz. heater cylinder developed especially for its 10D-8-oz. injection molding machines by Reed-Prentice Corp., Worcester 4, Mass. The unit is said to plasticize 100 lb. of material per hour. Ceramic heating elements, included as standard equipment, provide full contact.

The company states that no new mounting is required for installing the replacement heating cylinder on 10D-8-oz. machines manufactured between 1942 and 1952.



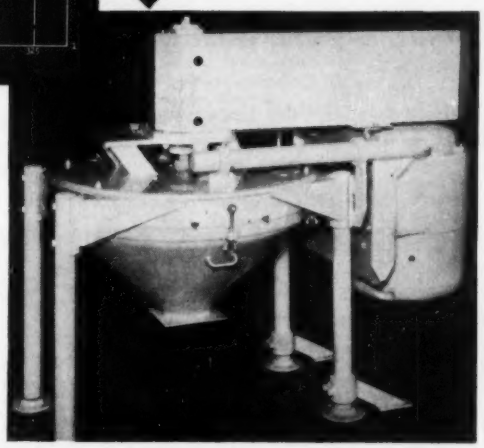
Reed-Prentice's replacement cylinder has up to 70% greater plasticizing capacity than old style

PARTICLE SIZE REDUCTION BY IMPACT!



Typical particle size curves . . . before and after processing material on the "ENTOLETER" Impact Mill

- **High Productivity Rates** per HP expended
- **Narrow Particle Size Range . . .** reduces quantity of "super fines"
- **Minimum Product Heating . . .** refrigeration rarely required
- **High Impact Velocities . . .** to 25,000 feet per minute dependent on application
- **Capacity . . .** up to 10,000 pounds per hour or higher on friable materials



Belt Drive "ENTOLETER" Impact Mill equipped with 25 HP motor

COMPACT . . .

a unit processing over 4 tons per hour occupies less than 14 square feet

SIMPLIFIED MAINTENANCE . . .

the single rotor and impact segments are readily removable for replacement

LABORATORY RESEARCH and DEVELOPMENT . . .

Possibilities for new "ENTOLETER" Impact Mill applications are being worked on continually in our laboratory in New Haven. We shall be glad to process samples and return them to you for your evaluation.

The trademark "ENTOLETER" is your guarantee of complete satisfaction.

ENTOLETER DIVISION
The Safety Car Heating and Lighting Company, Inc.
1197 DIXWELL AVE., NEW HAVEN 4, CONN.

BOOKS AND BOOKLETS

Write for these publications to the companies listed. Unless otherwise specified, they will be sent gratis to executives who request them on business stationery.

"Formaldehyde," by J. Frederic Walker.

Published in 1953 by Reinhold Publishing Corp., 330 W. 42nd St., New York 36, N. Y. 575 pages. Price $12.00.

Revised and brought up to date, this second edition of Walker's monograph (No. 120 in the American Chemical Society Monograph series) offers a systematic summary of the manufacture, properties, chemical reactions, and uses of formaldehyde. Advances in formaldehyde chemistry and technology which have taken place since publication of the original work (1944) are covered.

"Chimie des Colloides Organiques," by H. Staudinger.

Published in 1953 by Dunod, 92, Rue Bonaparte, Paris (VIe), France. 347 pages. Price: 2950 F. (ca. $8.50). In French.

This French translation of the 3rd edition of Herman Staudinger's *Organische Kolloidchemie* brings to the French-speaking research worker and fabricator a fairly definitive handbook on colloidal chemistry. The author, who originated the free-radical polymerization theory in 1920, presents a theory of colloids, involving a new classification of colloidal suspensions; tests for the determination of the constitution of colloidal particles, their size, and their shape; and methods of measuring the viscosity of such suspensions. The last two chapters of the book relate the subject of colloids (which is generally treated primarily from the physical standpoint) to organic chemistry and to biological processes.

"Data for X-Ray Analysis," Volume I by W. Parrish and B. W. Irwin, Volume II by W. Parrish, M. G. Ekstein, and B. W. Irwin.

Published by Research and Control Instrument Div., North American Philips Co., Inc., 750 S. Fulton Ave., Mt. Vernon, N. Y. Vol. I, 100 pages; Vol. II, 84 pages. Price: $2.00 each.

Volume I of this series contains charts for the solution of Braggs equation, charts covering K radiation for molybdenum, copper, cobalt, iron, and chromium, and a table that converts minutes into decimals of a degree. Volume II contains tables for computing the lattice constant of cubic crystals; tables give K radiation values for the square root of N times wavelength divided by 2 for copper, nickel, cobalt, iron, and chromium. A chart showing 33 representative cubic diffraction patterns is also included.

"ASTM Standards on Electrical Insulating Materials."

Published in 1953 by American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 590 pages. Price $5.25.

This latest coverage of electrical insulating material standards and related information contains 56 test methods and 16 specifications.

"Industrial Directory of New York State."

Published in 1953 by Dept. of Commerce, State of New York, 112 State St., Albany 7, N.Y. 1012 pages. Price $25.00.

Information on nearly 50,000 New York State manufacturing and mining firms is listed in the 1953 edition of this directory. Firms are listed alphabetically, by industry, and by geographical location. The industry breakdown has been made according to the U. S. Standard Industry Classifications.

Styrene copolymer — Properties, molding methods, applications, and the various types of the company's rubber modified styrene copolymer molding compound are presented in this booklet, entitled "Kralastic Molding Compounds." *Naugatuck Chemical, Div. of United States Rubber Co., 292 Elm St., Naugatuck, Conn.*

Hobs—A procedure to shorten the time cycle involved in the production of serviceable and inexpensive master hobs for use in making pressure-cast beryllium copper cavities is presented in this leaflet on "Trucast" beryllium copper castings. The preparation of patterns for making master hobs, the preparation of the master hob, problems of shrinkage, number of castings obtainable from a master hob, size limitations, etc., are also discussed. *Manco Products, Inc., P. O. Box 5231, Detroit 35, Mich.*

Plastics processing—Facilities, activities, and products of the company are detailed in Bulletin No. 150. Covered are extrusion and injection, the firm's line of plastics tubing, extruded gaskets, profile extrusions, etc. One page gives various conversion tables and a glossary of definitions. *Yardley Plastics Co., 142 Parsons Ave., Columbus, Ohio.*

Tetrafluoroethylene — Performance advantages of Teflon rings and gaskets are outlined in Bulletin P-1000. Also discussed are the design and operation of the company's line of triple action seal rings. *Halogen Insulator and Seal Corp., 10121 Franklin Ave., Franklin Pk., Ill.*

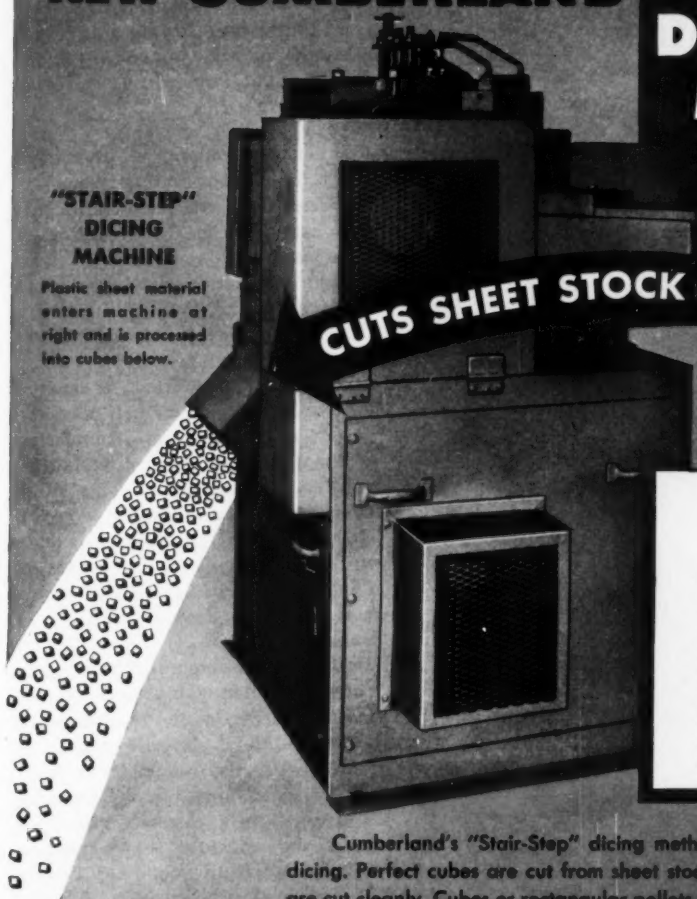
Dishes — Definitions and standards for times, temperatures, volumes, and spray patterns of wash and rinse waters in spray-type dishwashing machines are contained in N.S.F. Standard No. 3. This standard has been adopted by the Joint Committee on Food Equipment Standards and approved by the Council of Public Health Consultants. Price 50¢ per copy. *National Sanitation Foundation, Ann Arbor, Mich.*

Styrene — Tables of mechanical, thermal, optical, electrical, chemical, and molding properties of five grades of polystyrene—general purpose, heat resistant, high molecular weight, medium impact, and high impact—are given in the booklet "Erinoid Polystyrene Materials for all Purposes." Also included are general application notes for each of the grades. *Erinoid Ltd., Stroud, Gloucestershire, England.*

Couplers — The company's line of quick connect-disconnect couplers is presented in catalog VP 83. They are said to be capable of handling up to 80% flow of open pipe at pressures (for standard steel couplers) of up to 10,000 p.s.i. They are equipped with Buna packer to operate at temperatures from 0 to 270° F.; with

NEW CUMBERLAND "STAIR-STEP" DICING METHOD

Dices FULL RANGE of Plastic Materials!



"STAIR-STEP" DICING MACHINE

Plastic sheet material enters machine at right and is processed into cubes below.

CUTS SHEET STOCK INTO UNIFORM CUBES!

Now You Can Choose From TWO Cumberland Dicing Methods

NEW "STAIR-STEP" METHOD is the "universal" dicing method. It dices the *full range* of plastic materials having widely varying physical properties.

WELL-KNOWN "NOTCHED-KNIFE" METHOD dices vinyl materials of medium plasticizer content, vinylidene chloride, and other materials having suitable physical properties.

NOTCHED-KNIFE DICING MACHINE

Cumberland's "Stair-Step" dicing method offers you a *completely* new method of dicing. Perfect cubes are cut from sheet stock in one shearing action! All sides of cubes are cut cleanly. Cubes or rectangular pellets may be produced in various sizes (1/16" to 1/2") by simply changing knives.

WRITE FOR COMPLETE INFORMATION!

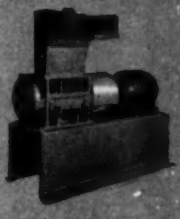
This new dicing principle makes it possible to dice the *full range* of plastic materials, including polyethylene, vinyl, acetate, and nylon. Two standard machine sizes accommodate sheets up to 7" or 14" wide. Machines to handle greater widths specially built.

CUMBERLAND MANUFACTURES A COMPLETE LINE OF PLASTICS REDUCING MACHINES

Designed Specifically for Plastics . . . . To Give You Maximum Operating Efficiency and Economy

GRANULATING MACHINES (All Models)

Eight different models, direct coupled and V-belt driven, are available to meet your requirements. For complete details, request Bulletin 251.



28" ALL-STEEL GRANULATOR

Rugged machine for granulating large "difficult-to-process" plastic parts. Eliminates prior band-sawing. 8" x 20" throat opening.

PREBREAKER

Cuts up refrigerator panels, radio, television cabinets, polyethylene bottles and containers. Available with 20" x 32" or 10" x 24" throat opening.

CUMBERLAND Engineering Company Inc.

BUILDERS OF BETTER MACHINERY FOR THE PLASTICS INDUSTRY

DEPT. J, BOX 236 PROVIDENCE, RHODE ISLAND

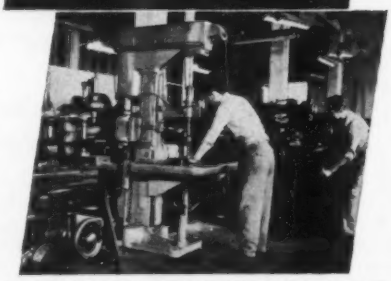
California Representative:
WEST COAST PLASTICS DISTRIBUTORS, INC.
4112 West Jefferson Blvd., Los Angeles 16, Cal.

E is for Facilities . . .

for injection molding at Lor-El

You'll like the way Lor-El employs its modern equipment (from 1 to 20 ounces) to supply you with fine injection moldings . . . particularly if you want experimental work done, in small sizes, in nylon and other thermoplastics. We can help you too.

Lor-El Company,
252 Paterson Plank Road,
Jersey City 7, N. J.
Phone: JOurnal Square 2-4066

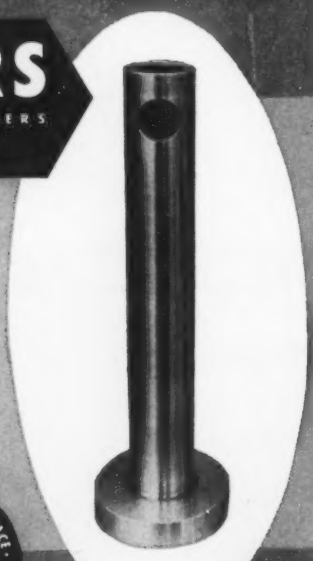


Lor-El

EXTRUDERS

FIND XALOY-LINED CYLINDERS
HARD TO BEAT!

- Xaloy liners can be adapted to any extruding equipment.
- Xaloy liners have absolute uniform surfaces, depth hardness.
- Xaloy minimizes contamination.
- Xaloy liners give longer service.



Xaloy — A FERROUS ALLOY SURFACE OF EXCEPTIONAL WEAR RESISTANCE

Xaloy 306 — NON-FERROUS ALLOY SURFACE EXCEPTIONAL CORROSION RESISTANCE

Write for Engineering and Production Data Book

INCREASE YOUR PRODUCTION! DECREASE YOUR COSTS!
• SPECIFY XALOY LINERS TO YOUR SUPPLIERS •

INDUSTRIAL RESEARCH LABORATORIES • 961 E. SLAUSON AVENUE
Division of Ronsdale Hill Corporation • LOS ANGELES 11, CALIF.

special packers they may withstand temperatures as low as —60 or as high as 400° F. Standard steel couplers can be used for air, water, gas, oil, and a variety of chemicals. *Snap-Tite, Inc., 201 Titusville Road, Union City, Pa.*

Maintenance economy — Advantages which the chemical industry can derive from synthetic resin-base coatings as a tool in the reduction of maintenance costs are outlined in an 8-page folder entitled "Bakelite and Vinylite Resin Coatings for the Chemical Industry." The brochure presents 16 case histories in which the chemical resistance of coated and uncoated equipments is compared; it also contains a tabulation of the effects of mineral acids, organic acids, alkalies, solvents, diluents, and miscellaneous corrosive chemicals on vinyl chloride-acetate resins. *Bakelite Co., a Div. of Union Carbide & Carbon Corp., 300 Madison Ave., New York 17, N. Y.*

Hydraulic equipment—The motor-driven and manual hydraulic presses manufactured by the company, as well as a line of pumps, are listed in Bulletin 10. Also included are technical data on pump circuits, bursting pressures, stroke displacement, cylinder and hydraulic ram capacities, water head equivalents, etc. *Clifton Hydraulic Press Co., 289 Allwood Rd., Clifton, N. J.*

Industrial equipment—The company's facilities for the fabrication of specialized equipment for processing, plant operation, handling, or storing are described in Bulletin 550. Such equipment includes mixers, pressure vessels, retorts, towers, tanks, stacks, diesel engine parts, large press bases, etc. The firm manufactures single units or mass-produced items in all specified sizes, and also offers design and installation services. *L. O. Koven & Brother, Inc., Engineering Sales Div., 154 Ogden Ave., Jersey City 7, N. J.*

Pumps—Applicable to continuous polymerization, esterification, nitration, fermentation, hydrogenation of fatty acids, high pressure syntheses, and similar operations, a complete line of motor driven volume-controlled pumps is described in Bulletin 553. They are of the reciprocating, positive displacement type, and

they are said to meter liquids in measured volumes against a positive pressure differential between suction and discharge accurately within 1 percent. Capacities range from 45 gal. per min. to 3 ml. per hr., pressures from 5 to 25,000 p.s.i. The bulletin, in addition to listing the various models, also contains capacity-pressure tables for proper pump selection. *Milton Roy Co., Station "C," 1300 E. Mermaid Lane, Chestnut & Hill, Philadelphia 18, Pa.*

Instrumentation index—A complete index to articles published in the company's quarterly magazine "Instrumentation" is presented in Bulletin 200-B. The bulletin contains a list of volumes and numbers from 1943 through 1952; an alphabetical index of all articles, by subject, published during this period; and an alphabetical listing of all companies and institutions about which these articles have been published. *Minneapolis-Honeywell Regulator Co., Industrial Div., Wayne and Windrim Aves., Philadelphia 44, Pa.*

Carbamide—Physical and chemical properties, present applications, and possible new uses for crystal urea are detailed in this booklet. The compound is presently utilized in the manufacture of urea-formaldehyde resin molding compositions, and it is suggested as a stabilizer for cellulosics and vinyls. *Nitrogen Div., Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y.*

Documentary—An informal study of the chemical industry as seen through some of the experiences and events of the company is portrayed in the documentary film entitled "Decision for Chemistry." Its aim is to show the role which the chemical industry plays on the American scene. Address inquiries to *Film Library, Advertising and Public Relations Dept., Monsanto Chemical Co., 1700 S. 2nd St., St. Louis 4, Mo.*

Industrial belts—Transmission conveyor and elevator beltings are discussed in this 48-page manual. Each type of belting is covered in a separate section comprised of a general and technical part. The general parts, written in question-and-answer style, are couched in non-technical language for the lay reader. The technical parts deal with those

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phases of belting of interest to engineers, recorded in tables, charts, and diagrams. *Boston Woven Hose & Rubber Co., P. O. Box 1071, Boston 3, Mass.*

Extruded thermoplastics—A table of properties comparing polyethylene, methacrylate, polystyrene, and fluorocarbons; forms in which the company's extruded plastics are available; and a list of their dimensions, surfaces, colors, and applications are contained in this 4-page booklet entitled "The Plax Extrusion Story." All test values listed in the brochure are based on A.S.T.M. test procedures. *Plax Corp., W. Hartford, Conn.*

Reinforced plastics — Performance charts and figures, as well as a brief discussion of various uses of the products are contained in this 8-page booklet entitled "What You Should Know about Molded Reinforced Plastics." *American Insulator Corp., New Freedom, Pa.*

Finishing machines—Overhead-monorail, conveyor-type, cabinet type, rotary-drum, and vertical-type machines adaptable to washing, rinsing, phosphate coating, pickling, drying, or any combination of these processes are described in this catalog. *Industrial Washing Machine Corp., Matawan, N.J.*

Industrial illustrations—Principles and techniques of three-dimensional drawings particularly as applicable to industrial uses, are described in step-by-step detail in a 92-page, profusely illustrated booklet entitled "Technical Illustrations." Considerable attention is given to the theories and mechanics of perspective and axonometric drawing. The book also contains sections on art materials used in various illustrating techniques, mechanical aids in three-dimensional draftsmanship, and rendering techniques (orthographic, ink outline, pen rendering, stipple shading, scratchboard, airbrush, and others). Price $2.50. *Higgins Ink Co., Inc., 271 9th St., Brooklyn 15, N.Y.*

Acrylic paint—Latest information on an acrylic resin emulsion having many of the properties of Plexiglas (water-white color, chemical resistance, and resistance to aging), are contained in a file folder on Rhoplex AC-33. The compound is designed for use in the production of fast-drying, odorless emulsion paints, and is said to offer many advantages both to the paint manufacturer and end user. Numerous paint formulation suggestions are included. *Resinous Products Div., Rohm & Haas Co., Washington Sq., Philadelphia 5, Pa.*

Silicones—In commemoration of its 10th anniversary, the company has released a brochure which sets forth the various properties of silicones. Titled "Tall Tales and Fabulous Facts," the publication pairs 11 Paul Bunyan-type tall tales with an equal number of summaries on silicone characteristics, making the point that today's "tallest tales" are told in technical terms. *Dow Corning Corp., Midland, Mich.*

Molding—Case histories of molds made by the firm, together with a brief description of the problems involved in each instance and how they were solved, are contained in this 24-page booklet entitled

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olyethylene Sheets
Compression molded thermoplastic sheet users now have available larger sizes of Acadia polyethylene. These are available in the new size of 36" x 36" x ⅛".
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"Moulds and Mouldings." *B. I. P. Tools Ltd., 1 Argyll St., London W. 1, England.*

Cellulosics—Properties, uses, and methods of forming Tenite I cellulose acetate and Tenite II cellulose acetate butyrate into finished products are covered in a 16-page booklet named "Tenite an Eastman plastic." *Eastman Chemical Products, Inc., Kingsport, Tenn.*

Heaters—A complete line of heating devices is listed in Catalog 53. Included are strip heaters, band-heaters, immersion heaters (portable and non-portable), and fin heaters. Controls, switches, melting pots, and other accessories are also included. *Waage Electric Inc., Kenilworth, N.J.*

Glass fabric impregnation—Presented in tabular form, electrical and mechanical properties of woven glass fabrics impregnated and coated with Teflon tetrafluoroethylene resin are described in this technical bulletin. Applications in the aircraft, chemical, food processing, packaging, paper, plastics, printing, rubber, textile, and other industries are suggested. *Fabrics Div., E. I. du Pont de Nemours & Co., Inc., Room 812, 350 Fifth Ave., New York 1 N.Y.*

Coatings—Uses and advantages of resin-base coatings in the petroleum industry are described in this 8-page folder. These coatings have good resistance to salt water, marine life, abrasion, acids, alkalies, and weather. They are easily applied and dry quickly. *Bakelite Co., a Div. of Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N.Y.*

Humidity control—Bulletin 374 investigates the problems of humidification and dehumidification in industry and in the home and describes the company's line of humidity-measuring and control equipment. *Abbeon Supply Co., 179-15 Jamaica Ave., Jamaica 32, N.Y.*

Cutting machine—Data sheet describes the operation and gives specifications of a round corner cutting machine, said to be capable of accurately cutting through piles of stock up to 4 in. thick without cutter deflection and without having to adjust either clamp or knife for differ-

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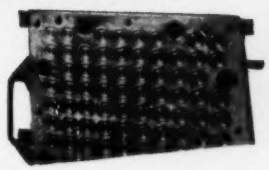
A free machining, low carbon, open hearth steel plate, stocked in thicknesses ¼" to 8". Tensile strength 58-72,000 p.s.i. At cutting speeds of 150-250 s.f.p.m. tool life averages 5 to 15 times that of other open hearth steels. It is easily carburized to achieve high surface hardness, and can be forged, cold formed, or welded, using proper techniques. Ideal for molds, dies, plates, fixtures, sprockets, etc.



80 cavity male Speed Case rubber mold. Machining costs lowered 41%.

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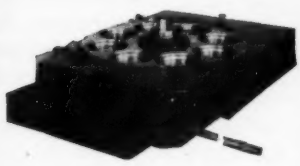

8 station ratchet dial feed, for "cupping" press, of Speed Treat.

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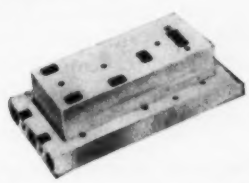

Carburized and hardened Speed Alloy mold, with hobbed cavities, made by W & L Molding Co., Kalamazoo, Mich. Note mirror finish.

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ent thicknesses. Pressure derives from a special toggle mechanism which imparts the same amount of pressure to the clamp as to the cutter, and thus prevents the work from slipping during the cutting operation. *Hobbs Mfg. Co., 26 Salisbury St., Worcester 5, Mass.*

Metal for mold-making—Beryllium products, in pure-metal, oxide, and alloy state, are described in Berylco Product Directory, a 20-page booklet outlining their various applications. *The Beryllium Corp., Reading, Pa.*

Fluorocarbons—The following engineering bulletins describe the company's Kel F and Teflon products, and its manufacturing facilities: No. 1001—technical data on Teflon; No. 1002—properties of Kel F; No. 1003—weight of Kelon rods and tubes; No. 1004—consolidated weight schedule; No. 1005—weight of sheets and strip; No. 1009—tubing weight per ft.; 1010—products manufactured by the company; No. 1011—facilities of manufacture; No. 1012—definitions and applications; No. 1013—O-ring information; and No. 1014—piston ring information. *W. S. Shamban & Co., 11617 W. Jefferson Boulevard, Culver City, Calif.*

Tape dictionary—Over 300 pressure-sensitive tapes are listed by number and manufacturer in this pocket-size Tape Number Dictionary P3-4. The listing contains, in addition to tape number and manufacturer's name, a brief description for each tape. Price 25¢ per copy. *Polyken Industrial Tape, 222 W. Adams St., Chicago 6, Ill.*

Injection machine—Bulletin 102 describes the company's Model 6 injection molding machine which combines a toggle mechanism and large-diameter, short-stroke hydraulic cylinder to produce high speed, 200-ton clamping. The machine's injection cylinder is said to be able to plasticize up to 60 lb. of polystyrene per hour. *Lewis Welding & Engineering Corp., 11 Interstate St., Bedford, Ohio.*

Adhesives—Origin of Penacolite (resorcinol-formaldehyde) adhesives and phenol-resorcinol-formaldehyde adhesive formulations are discussed in Bulletin C-3-149. Recommendations of types best suited for gluing of oak and for general assembly bonding are made. Penacolite adhesives G-1124, G-1131, G-1215, G-1260, and G-1288 conform to Military Specifications MIL-A-397A, Class I (General Service); and Penacolite adhesives G-1124 and 1260 to MIL-A-397A, Class 2 (Marine Service). *Chemical Div., Koppers Co., Inc., Koppers Bldg., Pittsburgh 19, Pa.*

Progress report — Commemorating the 10th anniversary of the company's research laboratory, "Miracles of Research" tells the story of the research that resulted in the development of a large variety of synthetic rubber compounds for use in the home, by industry, and by the government. *The Goodyear Tire & Rubber Co., Akron 16, Ohio.*

Coloring—Techniques used for dry-coloring with the company's styrene colorant blend molding compound are discussed in Product Information Bulletin 85. The booklet contains data on equipment, methods of obtaining special effects, molding aids,

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Replacement of line shafting and one motor with individual, compact, self-contained Sterling Slo-Speed Geared Electric Power Drives on three tumbling barrels increased production 25%, reduced power costs about 25%, decreased maintenance costs 20% and improved employee morale through greater plant safety, reports Allen C. Pearson, General Manager of Ace Plastic Co., Jamaica, N. Y.

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coloring aids, as well as a description of the process itself. Methods for achieving rigid color uniformity are also discussed. *Monsanto Chemical Co., Plastics Div., Springfield, Mass.*

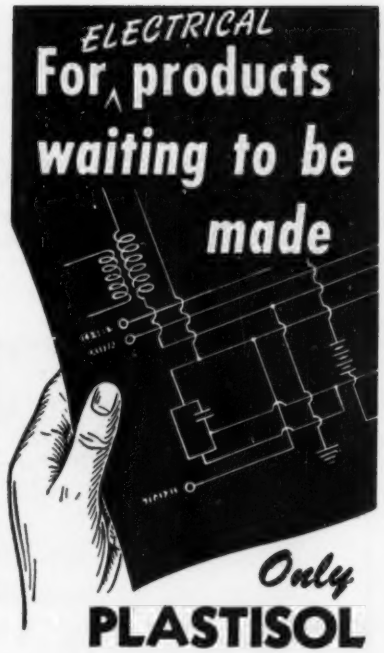
Film former—Characteristics of a new low-viscosity type cellulose acetate butyrate are described in technical data folder entitled "Half-second Butyrate Lacquer." Information on compatibility with some 125 natural and synthetic resins, oils, and waxes is presented, and formulation suggestions for wood, paper, metal, and plastics finishes, heat sealing adhesives, and melt coatings are made. *Eastman Chemical Products, Inc., Chemicals Div., Kingsport, Tenn.*

Web positioning—Bulletin 161 explains the operation of a web guiding edge position control system for use in printing, slitting, laminating, winding, and similar operations. A feature of the control system is the fact that nothing but a breath of air touches the controlled web edge. *Askania Regulator Co., 240 E. Ontario St., Chicago 11, Ill.*

Flock—Descriptions of various types of flock fibers, range of their uses, methods of applying flock to surfaces, and an explanation of proper adhesive selection are presented in 12-page booklet entitled "Cellusuede Flock." *Cellusuede Products Inc., 500 N. Madison St., Rockford, Ill.*

Emulsifiers-synthesizers — Technical data sheet No. 18 presents information on the properties and uses of aminohydroxy compounds. They find application in the production of polishes and cosmetic creams and lotions (as emulsifiers), and in the formation of various synthetic compounds. They are also effectively used to improve the stability of melamine-modified alkyd resin. *Commercial Solvents Corp., 260 Madison Ave., New York 16, N. Y.*

Rigid P. V. C.—A line of rigid polyvinyl chloride plates and sheeting offered by the company is presented in this 5-page brochure. Included are information on mechanical, thermal, and electrical properties of rigid polyvinyl chloride; a table showing the maximum operating temperatures at which it can be satisfactorily used in contact with various



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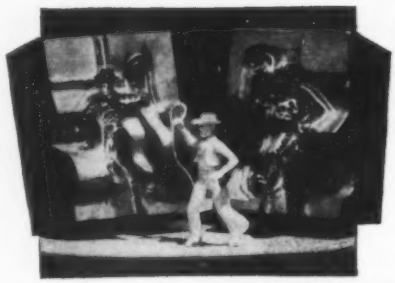

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acids, alkalies, salts, organics, etc.; and several application notes. A quantity-price list is appended. *Kaykor Industries, Inc., Div. of Kaye-Tex Mfg. Corp., Yardville, N. J.*

Control instruments—The second edition of "Cutting Costs with Electronic Controls" lists 46 new case studies illustrating the use of packaged electronic controls for weighing, counting, measuring, timing, and cycling operations. *Photoswitch Inc., 77 Broadway, Cambridge 42, Mass.*

Color and styrene—In-plant use of dry colorants, special effects obtainable, and price list are covered in a folder on Drycol. The company also offers a folder on its modified styrene sheet and tubing, with specifications, chemical properties, and recommended applications. *Gering Products, Inc., Kenilworth, N. J.*

Reinforced plastics—The first in a proposed series of technical bulletins deals with the problem of quality control for fibrous glass reinforced plastics, as applied by the company to its chopped strand mat reinforcement to keep weight tolerance to less than ±10 percent. *Bigelow Fiber Glass Products, Div. of Bigelow-Sanford Carpet Co., Inc., 140 Madison Ave., New York 16, N. Y.*

Polyvinyl acetate—Grades, properties, uses, and compatibilities of polyvinyl acetate solid resin in bead form are discussed in this 3-page bulletin. A list of plasticizers for use with this resin is also included. *The Colton Chemical Co., 1545 E. 18 St., Cleveland 14, Ohio.*

Custom molder—Facilities and products (thermoplastic and synthetic O-rings, Teflon O-rings, Teflon back-up rings, and hydraulic packings to commercial and government specifications) are presented in this latest catalog. Also included is a discussion of the firm's rubber-to-metal bonding process as well as O-ring installation recommendations. *Stillman Rubber Co., 5811 Marilyn Ave., Culver City, Calif.*

Aldehydes—Properties, characteristics, reactions, and uses of 14 aldehydes now sold by the company in commercial quantities, as well as information on aldehydes that are available in research quantities are

presented in this 36-page booklet entitled "Aldehydes." The chemicals find application in the manufacture of rubber, protective coatings, dyes, petroleum, plastics, and other products. Physical properties charts plot such variables as vapor pressures and specific gravity at various temperatures, freezing points, water solubility, boiling points, etc., and additional tables give specifications and test methods. *Carbide & Carbon Chemicals Co., a Div. of Union Carbide & Carbon Corp., 30 East 42nd St., New York 17, N. Y.*

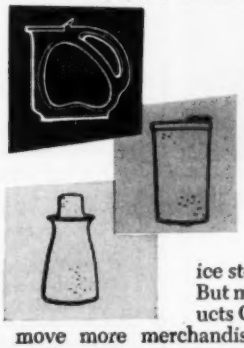
Fabricator—The work performed by the company and the facilities it has available for the fabrication of a wide range of plastics are described in this 16-page booklet. The firm specializes in the fabrication of plastics parts requiring close tolerances. *Steiner Plastics Mfg. Co., Inc., Pratt Oval, Glen Cove, Long Island, N. Y.*

Reinforced plastics—Advantages of polyester impregnated fibrous glass laminations, possible product applications, and a list of typical physical properties are presented in folder entitled "Is Molded Fiberglas the Answer?" *Kimball Mfg. Corp., 1270 Pennsylvania Ave., San Francisco 7, Calif.*

Thermoset catalog—Characteristics and applications of the company's melamine-formaldehyde and urea-formaldehyde molding compounds, polyester resins, resin adhesives, and laminating resin are listed in this catalog. A comprehensive table, which is also available as separate folder, lists the physical, electrical, and chemical properties of the two molding compounds. A "gluing-to-standard" guide in the adhesives section outlines the military and commercial specifications met by the materials. *American Cyanamid Co., 30 Rockefeller Plaza, New York 20, N. Y.*

Vinyl flooring—The question of the need for waxing vinyl floor covering is investigated in an article appearing in *Soap and Sanitary Chemicals*, reprints of which are available. The conclusions of the article are that vinyl flooring requires waxing for appearance, protection, and ease of maintenance. *MacNair-Dorland Co., 254 W. 31st St., New York 1, N. Y.*

— SAYS MR. DICK BURNHAM of B. W. Molded Products Company, Pasadena, California.



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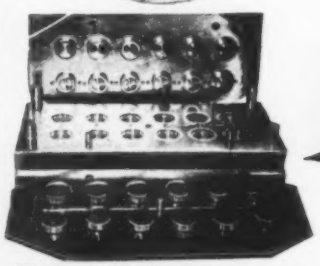

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Production of

FOR the purpose of this report, production is the sum of the quantities of materials produced for consumption in the producing plant for transfer to other plants

PLASTICS AND SYNTHETIC RESIN PRODUCTION
From Statistics Compiled

Materials	*Total p'd'n first 5 mos. 1953*	*Total sales first 5 mos. 1953*
CELLULOSE PLASTICS:[a]		
Cellulose acetate and mixed ester plastics:		
Sheets, under 0.003 gage	6,756,365	6,617,606
0.003 gage and over	5,528,914	5,307,379
All other sheets, rods and tubes	2,424,050	2,135,812
Molding, extrusion materials	32,416,901	32,218,723
Nitrocellulose:		
Sheets	2,999,382	2,528,456
Rods and tubes	230,222	315,503
Other cellulose plastics[b]	3,061,081	2,980,161
PHENOLIC AND OTHER TAR ACID RESINS:		
Laminating	33,992,698	23,179,777
Adhesive	21,047,610	19,349,236
Molding and casting materials[a]	98,397,064	96,485,164
Protective coatings (modified and unmodified except by rosin)	13,586,855	12,202,195
Miscellaneous uses	35,536,451	31,048,345
UREA and MELAMINE RESINS:		
Adhesives	34,725,713	33,765,263
Textile-treating resins	14,157,312	14,104,296
Paper-treating resins	9,587,138	9,483,895
Protective coatings, modified and unmodified	12,835,792	9,638,574
Miscellaneous uses, including laminating and molding[c]	31,860,966	34,248,012
STYRENE RESINS:		
Molding materials[a]	145,200,409	134,438,602
Protective coatings, modified and unmodified	36,833,985	37,145,692
Miscellaneous uses	37,481,294	33,553,914
VINYL RESINS:[d] Total	225,340,276	212,720,516
Sheeting and film (resin content)[e]		66,312,327
Adhesives (resin content)		9,548,853
Textile and paper-treating resins (resin content)[f]		22,439,948
Molding and extrusion materials (resin content)		73,081,205
Protective coatings (resin content)		12,004,156
Miscellaneous uses (resin content)		15,562,511
COUMARINE-INDENE AND PETROLEUM POLYMER RESINS:	74,354,166	72,577,232
MISCELLANEOUS SYNTHETIC PLASTICS AND RESIN MATERIALS:		
Molding materials[a,g]	56,732,200	52,612,923
Protective coatings[h]	3,397,326	2,100,906
All other uses[i]	54,966,700	54,703,406

[a] Dry basis is designated unless otherwise specified. [b] Includes fillers, plasticizers, and extenders. [b] Includes sheets, rods, and tubes, and molding and extrusion materials. [c] Data on resins for laminating and miscellaneous uses are on a dry basis; data on molding materials are on the basis of total weight. [d] Production statistics by uses are not representative, as end use may not be known at the time of manufacture. Therefore, only statistics on total produc-

Plastics Materials

of the same company, and for sale. Sales include only the quantities involved in bona fide sales in which title passes to the purchaser.

IN POUNDS* FOR APRIL AND MAY 1953
by U. S. Tariff Commission

April 1953		*May 1953*	
Production	*Sales*	*Production*	*Sales*
1,415,317	1,355,596	1,495,989	1,351,845
1,296,867	1,101,077	1,222,097	1,222,577
472,068	426,438	524,576	417,117
7,043,714	6,884,477	6,072,575	6,224,810
615,150	518,373	609,422	460,824
43,467	63,172	52,796	52,327
602,072	596,206	682,904	641,713
7,064,686	5,092,824	6,562,916	4,292,923
3,867,577	3,533,914	4,020,919	3,650,729
23,286,772	20,906,332	20,795,578	18,339,756
2,673,588	2,537,084	2,814,046	2,451,878
7,332,148	6,096,706	6,919,876	5,800,661
7,782,399	8,151,167	7,732,395	7,161,507
2,747,592	2,517,303	2,536,377	2,338,327
1,169,597	2,136,967	2,314,089	1,786,413
2,956,491	2,357,734	2,529,318	1,949,174
6,798,129	7,337,572	7,273,418	6,593,995
27,793,849	29,572,839	32,272,782	25,676,184
8,020,514	8,408,836	8,065,555	7,320,889
7,969,756	7,271,108	7,101,150	6,629,352
46,295,482	43,976,240	46,789,782	39,433,204
	16,574,133		14,765,848
	1,990,838		1,762,453
	4,934,015		4,126,310
	15,331,652		13,509,487
	2,344,895		2,185,478
	2,800,707		3,083,628
15,244,141	13,628,734	13,450,829	14,086,805
11,672,758	10,691,203	11,513,219	10,202,046
726,092	451,784	680,706	366,987
10,784,865	10,622,166	11,690,629	11,139,951

tion are given. * Prior to January 1951, statistics were given on the basis of total weight. † Includes data for spreader and calendering-type resins. ‡ Includes data for acrylic, polyethylene, nylon, and others. § Includes data for epichlorohydrin, acrylic, polyester, silicone, and other protective coating resins. ¶ Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.

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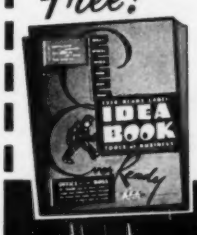

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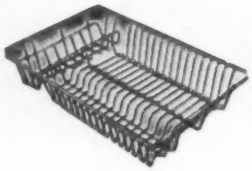
VINYL PLASTISOLS



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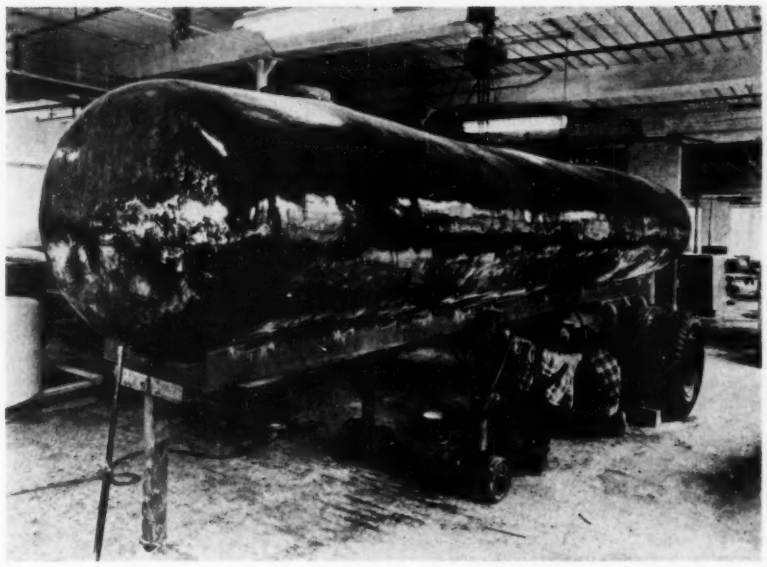

Polyester-glass reinforced tank—to be used in the trucking of formaldehyde and similar corrosive chemicals—is fitted to the chassis of a specially designed trailer

Reinforced Plastics Transport Tank

AN experimental 3400-gal. reinforced plastics transport tank, stated by the manufacturer to be the first of its kind in the United States, is now ready to take to the roads—a move that may mark the beginning of a new concept in the commercial transportation of bulk liquids.

The tank, which will be used by P. B. Mutrie Transportation, Inc., Waltham, Mass., to haul formaldehyde and similar liquid chemicals, was molded by Carl N. Beetle Plastics Corp., Fall River, Mass., using American Cyanamid's Laminac polyester resin reinforced with fibrous glass. The same molding methods that are used in the manufacture of transport tanks designed for desert operations (see "Tanks for the Desert" MODERN PLASTICS *29*, 76, June 1952) were applied to the production of the new tanks.

In size, the tank is one of the largest one-piece molded structures ever made. It measures approximately 22 ft. long, 6 ft. wide, and 4½ ft. high, unmounted. When fully equipped and mounted on the specially built trailer, the tank weighs only 7025 lb., some 3600 lb. less than the steel tank it replaces. This difference in weight permits the material being carried in the tank to be increased within the limits of the 50,000 lb. over-the-road maximum.

Unlike the steel tank, the plastics unit requires no special lining or interior treatment and can therefore be mass-produced more economically than the steel type. Again, in comparison to steel, the plastics tank is far more resistant to corrosion, requires less maintenance, and is easier and more inexpensively repaired.

Lightweight plastics construction of tank allows greater payloads

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Model JP Gardsman $185.

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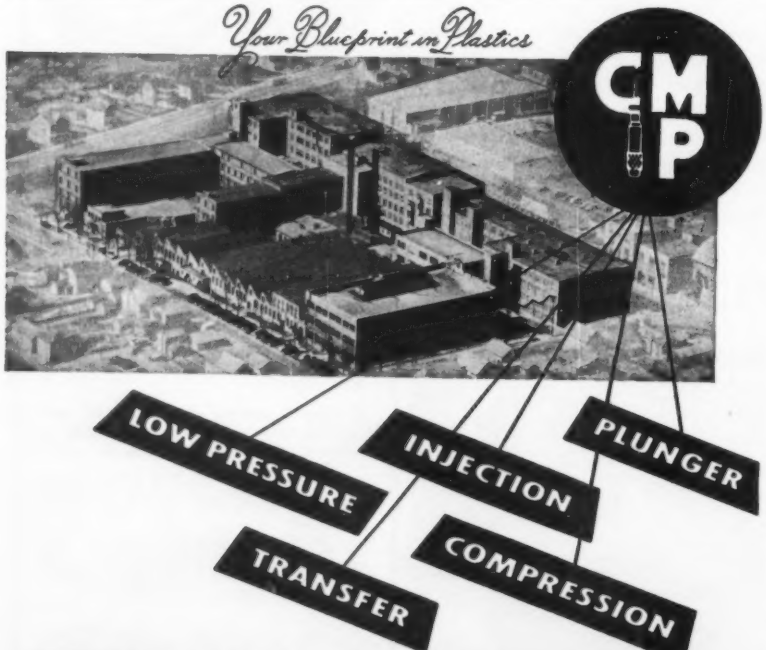

Consolidated molded products corporation
SCRANTON 2, PENNSYLVANIA
SALES ENGINEERING OFFICES IN NEW YORK BOSTON BRIDGEPORT
DETROIT PHILADELPHIA CLEVELAND MILWAUKEE INDIANAPOLIS

Reinforced plastics shield stops small-arms fire even at point-blank range

Police Shield

CONSIDERABLE interest has been aroused by a light-weight reinforced plastics body shield which has been displayed recently at law enforcement agency conventions. The shield, dubbed "The Little Joe," is the result of over a year of cooperative development work on the part of the designer, T. J. Goeckner, Compton, Calif., and Swedlow Plastics Co., Los Angeles, Calif. Fabrication of the shield is carried out by Mr. Goeckner, using flat sheet laminate supplied by Swedlow.

Basically, the laminate is made up of Fiberglas mat with a modified polyester binder. It is supplied in a thickness of approximately 0.225 in. and weighs about 2.15 lb./sq. foot.

Purpose of the shield is to serve as portable protection for law enforcement officers against small-arms gunfire.

In a recent series of tests, a number of standard weapons—ranging from a 12-gage shotgun to a .45 caliber army pistol—were fired point blank at a shield held by a police officer some 20 ft. from the weapon. In each case, the fired slugs were stopped by the resin-impregnated fibrous glass; the multiple plies of the material delaminated, with resultant absorption of the energy of the projectile.

The shield, complete with a handle and a bullet-proof glass window, weighs only 11 lb. and is still large enough to completely cover the body of the policeman when crouching or kneeling.

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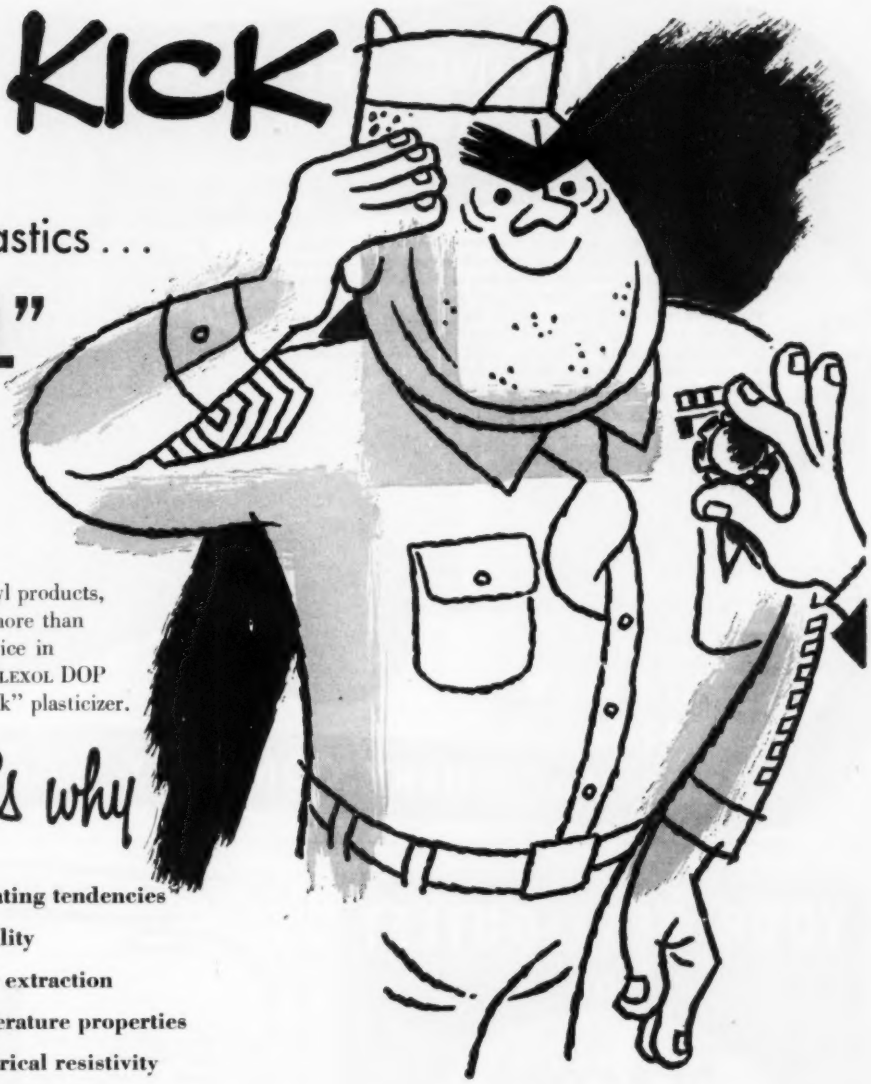

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- **High compatibility**

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Concerning properties, prices, and delivery of FLEXOL plasticizer DOP? Call or write any of our 21 offices located in principal cities. In Canada: Carbide and Carbon Chemicals, Limited, Toronto.

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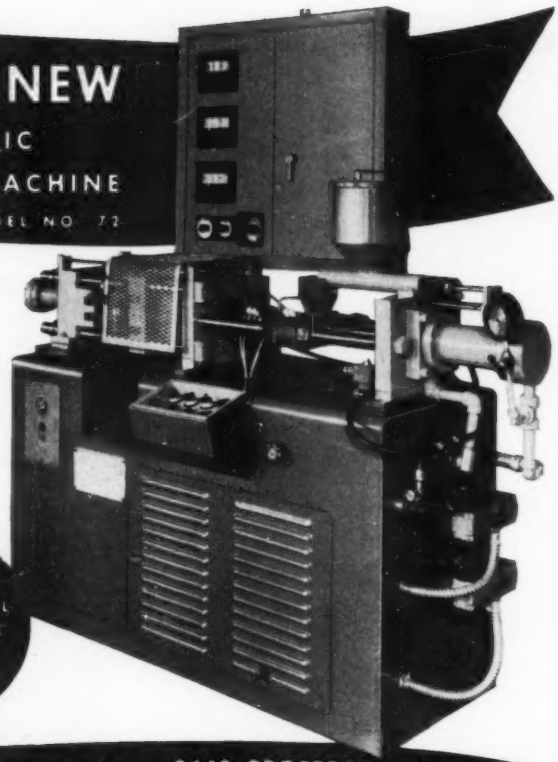
2 OUNCE MOSLO HYDRAULIC PLASTIC INJECTION MOLDING MACHINE

MODEL NO. 72



Here is the Moslo 2 Ounce Horizontal Hydraulic Plastic Molding Machine you have been waiting for, to do production molding of small pieces with low mold cost. Built along the lines of larger machines it will shoot a 2 ounce plus shot, and will hold better than 20½ square inches of molding area. Our special 4 Point Toggle Clamp with calibrated adjusting nuts for mold alignment together with the famous Moslo "Radee" Cylinder of stainless or nickel steel guarantees the above statement.

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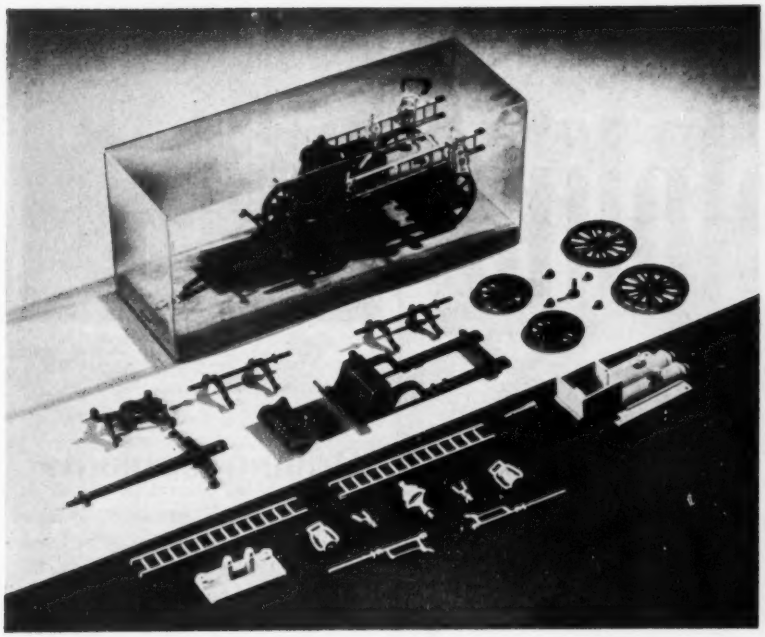


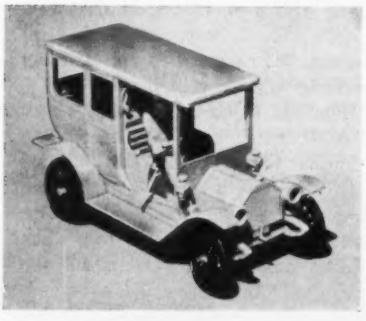
Cellulose acetate parts molded in bright and integral colors can be speedily assembled by the hobbyist into a scaled-down replica of an early American fire engine

Molded Acetate Hobby Kits

READY-to-assemble construction kits, with parts molded of cellulose acetate, have forged to a position among the leaders in sales to amateur home craftsmen. The kits, based on the various modes of transportation of early America, each contain all the parts necessary to assemble an authentic model of a vehicle of by-gone days.

The subjects of the kits run the full gamut of transportation. Marlin Toy Co., New York, N.Y., for example, offers a series of early American fire engines, with detailed parts molded of Tenite I cellulose acetate by W & A Co., Inc., Attleboro, Mass.

1910 Cadillac limousine is one of models available in hobby kit



Another leader in the field, Revell Toys, Los Angeles, Calif., packages a kit for modeling miniature antique autos. Parts for the Revell kit are molded of Celanese acetate by Arrow Molders, Inc., Inglewood, Calif., and J. P. C. Molders, Inc., Goleta, Calif.

For both the fire engine and automobile kits, the parts—usually from 25 to 30 per unit—are molded in family molds that produce the majority of the components in a single shot. Individual parts are then cut off the sprue and packed, together with detailed instructions, in boxes or bags ready for assembly by the hobbyist.

By selecting acetate as the molding material, the manufacturers are able to offer the kits at prices often less than a dollar—and still maintain a high quality standard. Acetate can be molded for accurate detail at high speeds. It is a tough material, yet flexible enough to be bent during assembly operations; it can be cemented rapidly and permanently; it can be molded with bright integral coloring; and its natural surface gloss takes paint easily should extra decoration be desired for special effects.

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manufactured by
SCHWARTZ CHEMICAL CO.

REZ-N-LAC
for STYRENE

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VINA-PLAS
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REZ-N-LAC, developed especially for styrene products, is non-toxic, non-crazing, and cannot scratch off. Clear, white, transparent or opaque colors.

VINA-PLAS brings high lustre to vinyls and plastisols. Air dries in five minutes. Excellent adhesion. A sparkling washable coating. Easy to apply; wide range of colors. One and five gallon cans, 55 gallon steel drums.

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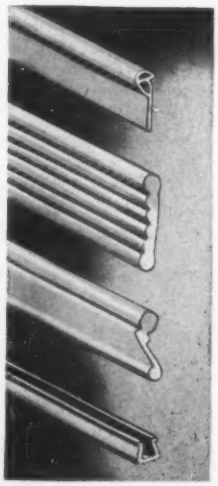

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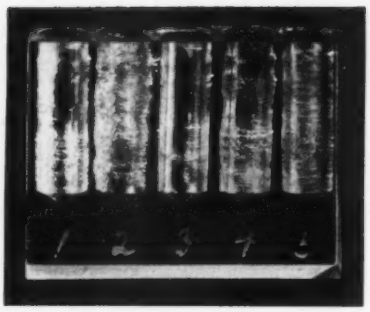

Effect of the use of various coolants in drilling thermoplastics

Drilling Coolants

RECENT studies indicate that silicone-based coolants may be used with high speed equipment to drill, tap, and ream holes in hard or soft thermoplastics. Finished holes are equal in quality to those molded in place with insert pins, and are produced at a fraction of the cost.

Conducted by Dow Corning Corp., Midland, Mich., the investigations also showed that silicone-cooled equipment machined faster and required less power than when cooled with conventional materials.

Detailed experiments were made on styrene plastic, as illustrated in the accompanying photograph. A ½-in. drill was used to bore five holes 1¾ in. deep. A wattmeter and a tachometer were used to check power consumption and revolutions per minute. A common medicine dropper was used to apply various coolants. The results were:

Hole No. 1, soap and water coolant, 625 r.p.m., 12 to 37 w., shredding after ¾-in. enlarged bore.

Hole No. 2, turpentine coolant, 625 r.p.m., 11 to 47 w., shredded after each lubrication.

Hole No. 3, Dow Corning 35B silicone emulsion coolant diluted with 6 parts of water, 625 r.p.m., 13 to 30 w., excellent all the way.

Hole No. 4, organic cutting oil coolant, 625 r.p.m., 9 to 26 w., badly gummed and shredded.

Hole No. 5, no coolant, 625 r.p.m. 9 to 37 watts.

Similar tests results were obtained with other plastics such as molded styrene copolymer, molded cellulose acetate, and molded saran. The effectiveness of the various silicone emulsion dilutions varied according to the type of plastic used.

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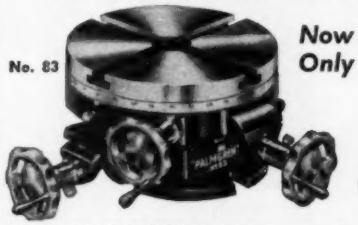

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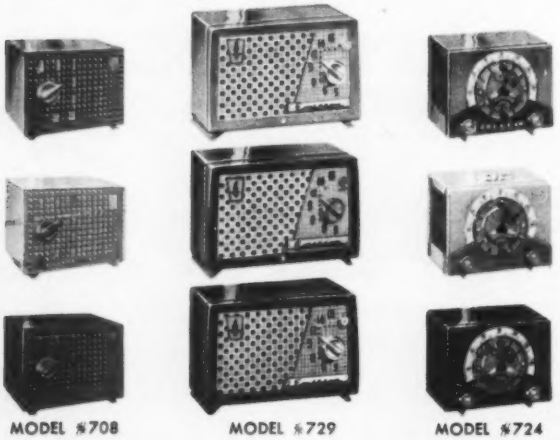

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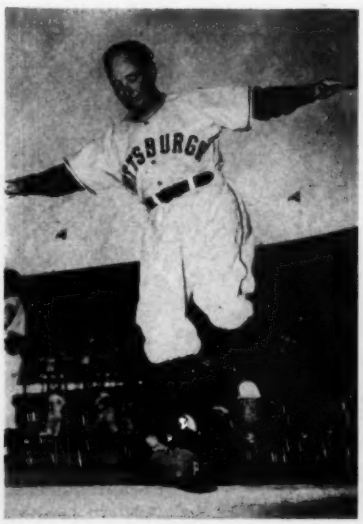

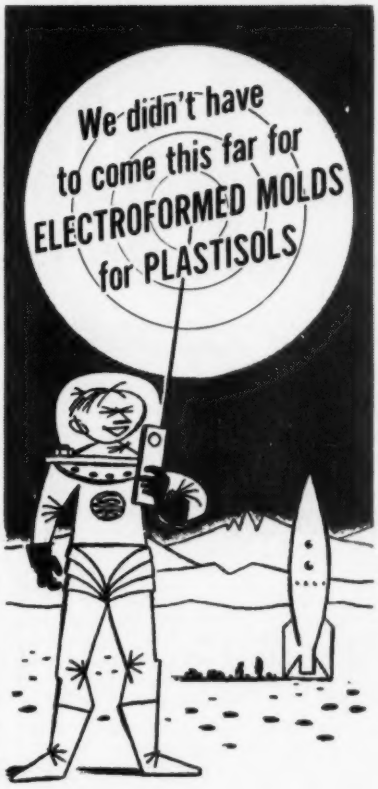

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NYLON PLASTIC BALLS. Bulletin lists the various standard sizes in which Ace nylon balls are available for use in valves, anti-friction bearings, and other industrial applications. Describes mechanical, thermal, and chemical properties of the nylon material. Ace Plastic Co. (J-301)

"TEFLON." Technical data sheet discusses woven glass fabrics, tapes, and laminates impregnated and coated with "Teflon" tetrafluorethylene resin. Chart lists their electrical, mechanical, thermal, chemical, and forming properties. E. I. du Pont de Nemours & Co., Inc. (J-302)

PLASTICIZER. Technical bulletin discusses the physical properties, performance data and suggested uses of "Plastolein 9057 DIOZ," a low viscosity primary plasticizer for nitrile rubbers, vinyls, and cellulosics recommended where low temperature performance is essential. Emery Industries, Inc. (J-303)

COLOR MATCHING. Illustrated catalog on techniques for matching and reproducing visually perfect colors in polystyrene. Gives full information on color differences, color measuring instruments, methods of dye testing, and basic industry terminology. Koppers Co., Inc. (J-304)

PLASTIC SCRAP GRINDER. Folder on the profitable grinding of plastic sprues, gates, warm-up shots, and rejects into homogeneous granules for uniform mold flow using the American Rotary Knife Chopper. American Pulverizer Co. (J-305)

COATING RESINS. Data on "Araldite" Resin 985 E which has considerable covering power on metals and is used as a liner for cans and collapsible tubes for corrosion protection. Ciba Co., Inc., (J-306)

SURFACE CLEANING. Bulletin illustrates and describes standard cabinet, single, and two-operator model "Vapor Blast Liquid Honing" machines for surface-cleaning precision parts, dies and molds, removing oxides, de-burring, and preliminary finishing of surfaces. Vapor Blast Mfg. Co. (J-307)

POLYESTER-TYPE RESIN. Technical sheet contains information on Narmco Resin Formula 3117, a low viscosity polyester resin used for casting, sealing, and impregnation of fabrics. Narmco Resins & Coatings Co. (J-308)

PERFORATING OF PLASTICS. Folder contains sample swatches of films, rigid sheets, and coated plastics perforated with various sizes and spacing of holes for ventilation, air escape, light transmission, and decorative applications. The Harrington & King Perforating Co. (J-309)

SHEETS, RODS, AND TUBES. Catalog of price lists covers sheets, rods, and tubes made of acrylic, cellulose acetate, rigid and flexible vinyl, polystyrene, nylon, and cellulose actate butyrate. Cadillac Plastic Co. (J-310)

MOLDS FOR PLASTICS. Catalog fully illustrates and discusses beryllium copper castings for mold cavities and cores produced by vacuum, centrifugal or pressure casting. Also shown are the special processes, machinery and fabricating equipment used to make molds for plastics. Standard Tool Co. (J-311)

PRESSURE SWITCHES. Electrical rating chart, specification data, and special features of the "Meletron" line of pressure and vacuum-actuated switches for use in hydraulic systems, are contained in a booklet issued by Barksdale Valves. (J-312)

VINYL STABILIZERS. Series of five data sheets cover the physical properties of Harshaw-V-Stabilizers for increasing the heat and light stability of polyvinyl chloride, plastisols, and other vinyl copolymers. The Harshaw Chemical Co. (J-313)

MARKETING STYRENE PLASTIC HOUSEWARES. Report on a study to determine the distribution channels for styrene plastic housewares, potential volume of housewares through each distribution channel, marketing methods, price lines, markups, and similar data. Monsanto Chemical Co. (J-314)

COATING AND DECORATING. Technical data sheet describes "Vinaplas-Lac," a decorative coating for flexible vinyls, plastisols, and plastigels which may be dip-coated, sprayed or brushed on to yield a tough acid, alkali, and chemical-resistant film. Schwartz Chemical Co., Inc. (J-315)

PLASTISOLS AND PLASTICIZERS. Catalog gives specifications of the RC ester-type plasticizers used in films and sheetings, extrusions, molded objects, and coatings. Performance data on dipping, molding and casting plastisols for coating fabrics, dip coating of metal parts, and slush molding, also included. Rubber Corp. of America. (J-316)

HYDRAULIC PUMPS AND CONTROLS. Data on various Vickers pressure, volume, and directional controls, hydraulic motors, transmissions, and cylinders. Specifications included. Vickers, Inc. (J-317)

STYRENE-BUTADIENE REINFORCEMENT FOR RUBBER. Booklet has information on the use of "Pliolite" 56B styrene-butadiene copolymer as a reinforcing additive in the manufacture of leather-like and rubber materials. Details on processing and compounding. The Goodyear Tire & Rubber Co. (J-318)

VINYL UPHOLSTERY. Booklet illustrates ways in which "Koroseal," a crack, stain, scuff, fade, and flame-resistant vinyl sheeting has been put to use by various manufacturers. The B. F. Goodrich Co. (J-319)

ALKYD RESIN. Discussion on "Duraplex ND-79," a non-oxidizing, high-gloss, color-retentive alkyd used in the production of white baking enamels for stove coatings and washing machines, is contained in a set of technical data sheets released by Rohm & Haas Co. (J-320)

VERTICAL INJECTION MACHINE. Specification sheet on the Watson-Stillman 2-oz. vertical injection molding machine for laboratory testing, research, and products development. Watson-Stillman Co. (J-321)

PLASTIC INJECTION MOLDING MACHINES. Specifications, operating and price data on the 2¼-oz. Moslo "Universal" plastic injection molding machine for manual or semi-automatic operation. Moslo Machinery Co. (J-322)

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COPPER CASTINGS. Data on the properties of beryllium copper master hobs for use in making "Tru-Cast" beryllium copper castings for novelty and toy items. Details on the preparation of patterns of plastic, plaster, or wood for hob fabrication. Manco Products, Inc. (J-323)

PLASTICIZER. Information sheet contains description and physical properties of dibutyl phthalate, a stable, colorless and odorless ester, for use in polyvinyl chloride coatings and as a plasticizer for nitrocellulose lacquers. Witco Chemical Co. (J-324)

MOLDING GLASS-FIBER REINFORCED ALKYDS. Bulletin contains latest available information on transfer and compression molding techniques for use with Plaskon 440 glass-fiber reinforced alkyd molding compound. Plaskon Div., Libbey-Owens-Ford Glass Co. (J-325)

TEMPERATURE CONTROL UNIT. Data sheet describes new "straight line" temperature controller that automatically compensates for heat transfer lags. Includes specifications, diagrams, and applications. Wheelco Instruments Co. (J-326)

TESTING INSTRUMENTS. Testing instruments for determining weight, bulk or thickness and bursting strength of plastic, metal, fabric, paper, rubber, foil, glass, etc., are described and illustrated in a pamphlet issued by E. J. Cady & Co. (J-327)

GRINDER. The vibrationless Model PG-7 centerless grinder with automatic hopper for production of circular formed parts made of plastics, wood, ceramics, or hard rubber is described in a specification bulletin issued by Royal Master Metal Products Co. (J-328)

HYDRAULIC PRESSES. Catalog containing illustrations and data on French presses for hobbing, die-sinking, forming, laminating, and compression and transfer molding. The French Oil Mill Machinery Co. (J-329)

VINYL PLASTICIZER. Booklet discusses physical properties, plasticizing properties, test results, compositions, suggested formulations, stabilization, and other data about MPS-500, a new low-cost plasticizer. Hooker Electricochemical Co. (J-330)

AUTOMATIC CUTTER. Full details on the "Automatic Production Cutter" which cuts paper, plastics, cloth, and other soft materials into uniform sheet sizes using an electronic measuring device for predetermined lengths. Hobbs Mfg. Co. (J-331)

USE OF PASTE COLORS WITH POLYESTER RESINS Pamphlet on the development, uses, and advantages of paste colors for polyester formulas contains details on the mixtures of organic and inorganic compounds necessary to produce various shades. Ferro Corp. (J-332)

HYDRAULIC DIE PRESS. House organ gives complete details on the "Champion" hydraulic die press for high-pressure paper cutting, and contains other information on the progress and history of Greer Hydraulics, Inc. (J-333)

"SELECTRON" POLYESTER REINFORCING RESIN. The general properties, curing characteristics, catalysts, stability, and special types of "Selectron" polyester resins are described in a manual published by Pittsburgh Plate Glass Co. (J-334)

LAMINATED MATERIALS. Booklet contains detailed list of general physical properties and of specific uses for which Spaulding fiber-based laminated products have proved adaptable in industrial applications. Engineering reference data on using sheet, tube, and rod pipes. Spaulding Fibre Co., Inc. (J-335)

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FOILS FOR HOT DIE STAMPING. Data on the hot stamping process for decorating plastic products with metallic and standard colors. Lists the hot stamping machines made by various manufacturers and describes "Nue-Hue" and "Dri-Hue" stamping foils. M. Swift & Sons, Inc. (J-338)

LEAD SCREW TAPPING. Price list, setting up instructions, and illustrated information on the "Auto-tap" lead screw tapping attachment for converting a standard drill press into a precision tapping machine, are contained in a brochure released by Automatic Methods, Inc. (J-339)

"VINSOL" RESIN. Bulletin describes and gives properties of "Vinsol" a thermoplastic resin available in pulverized, flake, and lump forms for use in adhesives, electrical insulation, plastics, and protective coatings. Chart shows its degree of solubility and compatability with different materials. Hercules Powder Co. (J-340)

PLASTICIZERS AND CARBON BLACKS. Latest price list of the carbon blacks and plasticizers manufactured by Godfrey L. Cabot, Inc. (J-341)

CUTTER AND TOOL GRINDER. Full descriptive catalog on the Cincinnati "Monoset" cutter and tool grinder for making new end mills, reamers, counterbores, etc., and for reconditioning old ones. The Cincinnati Milling Machine Co. (J-342)

MOLD AND DIE MAKING EQUIPMENT. Booklet contains information about die-sinking and engraving machines designed and built to meet the needs of modern mold and tool work. Complete specifications and descriptions. Price list included. J. Arthur Deakin & Son. (J-343)

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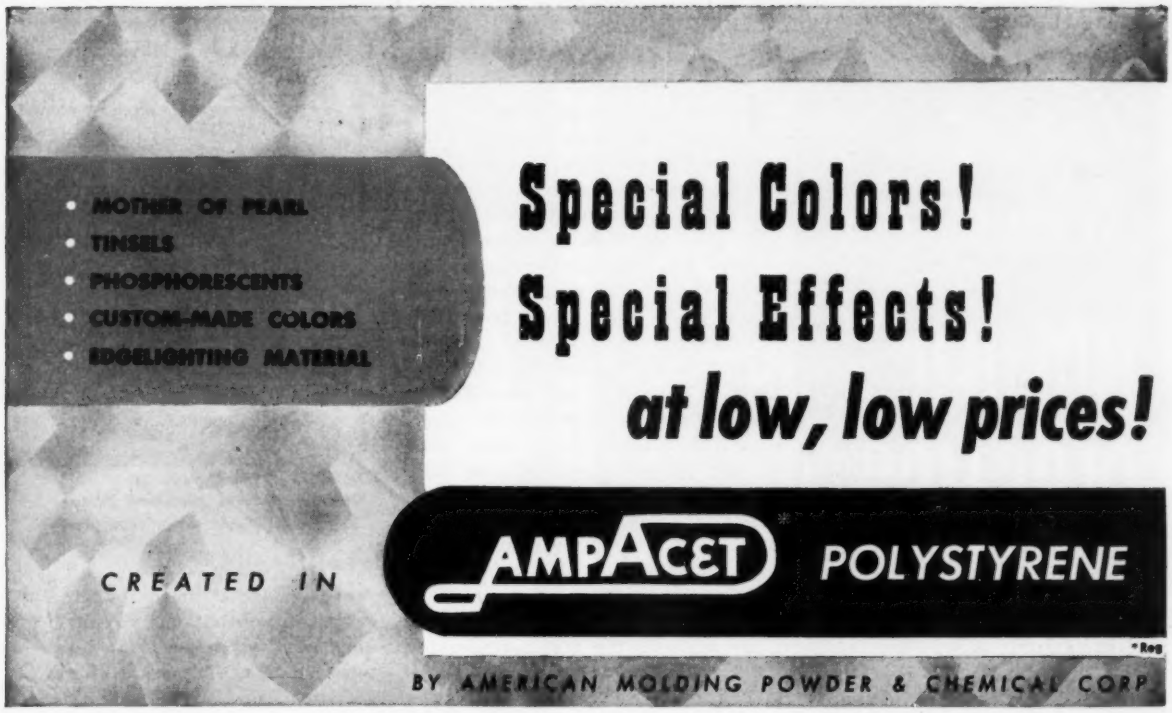

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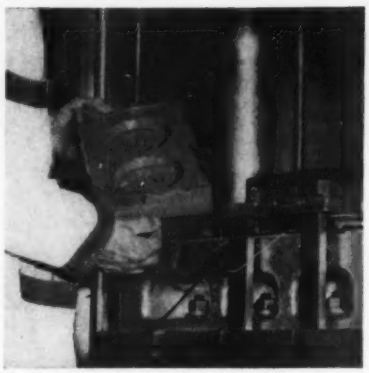
Alkyd Resin in Core Driers

A NEW type reinforced plastics core drier has been developed by Formed Plastics Co., Toledo, Ohio, to replace aluminum core driers used in the manufacture of foundry cores for precision metal castings.

Instead of the lay-up method by which most other reinforced plastics core driers have been made (see "Foundry Core Driers," MODERN PLASTICS *29*, 108, Dec. 1951), the new unit is molded on a Stokes 200-ton semi-automatic compression press, using a Plaskon alkyd resin compound reinforced with fibrous glass. In the core driers thus produced, cores are made from a mixture of sand and a water solution of urea-formaldehyde or phenol-formaldehyde. When this core mixture is baked at temperatures between 250 and 300° F., the water evaporates, converting the core mixture into an insoluble, infusible mass.

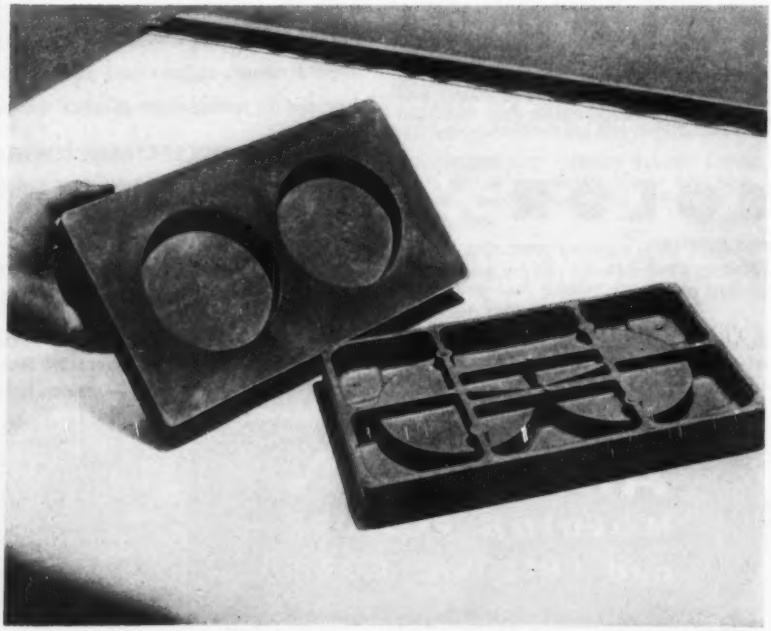
Previous to the switch to reinforced plastics, foundrymen could not take advantage of dielectric heating for this baking operation. Metal core driers conduct the high frequency radio waves rather than provide the resistance necessary to produce the baking heat. As a result, the baking of synthetic resin-bonded cores in metal driers had to take place in conventional drying ovens and required a 30-min. to 4-hr. exposure, depending on the size of the foundry core being made. In contrast, foundry cores supported in the non-conductive reinforced plastics driers can be baked in a dielectric oven in as little as from 20 sec. to 20 minutes.

In addition, the plastics driers are reported to cost only ⅓ to ½ as much as the metal driers which have been generally used in the past.



Photos courtesy Stokes Machine Co.
Operator removes reinforced plastics drier from 200-ton compression press

Foundry core driers are compression molded of alkyd resin molding compound reinforced with fibrous glass. Underside of each drier (right) is molded with reinforcing ribs



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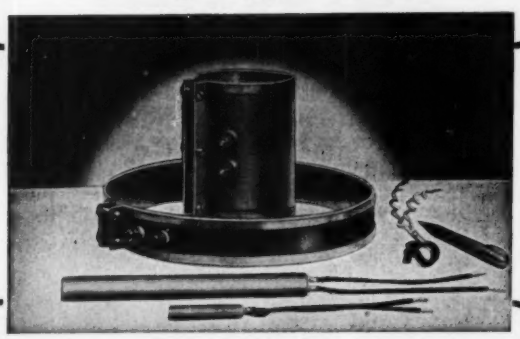

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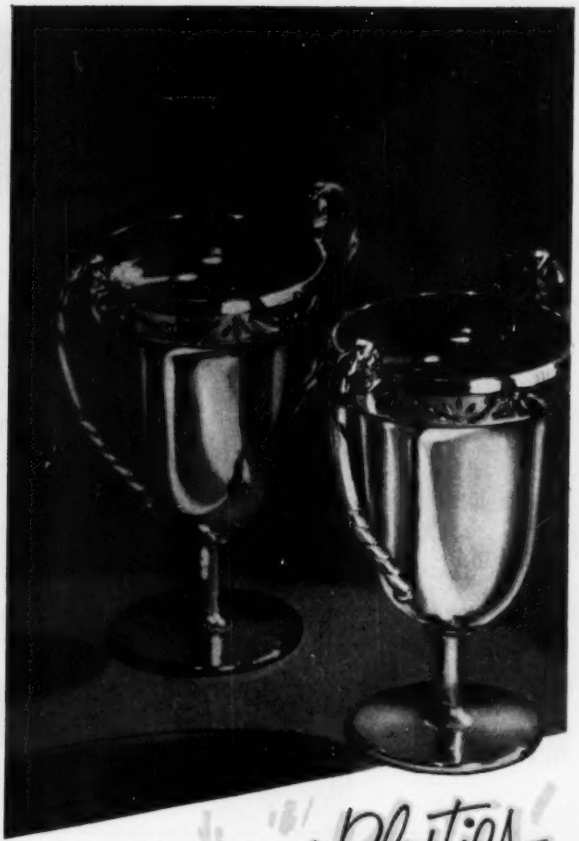

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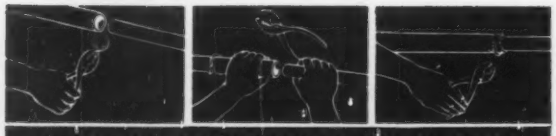

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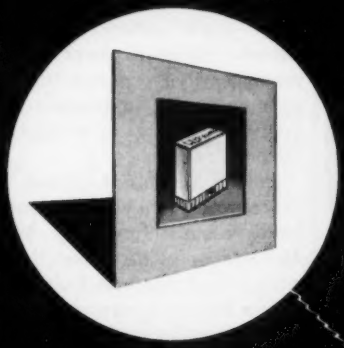
Styrene mixer for powdered milk, batters, etc., also makes handy pitcher

Styrene Mixer

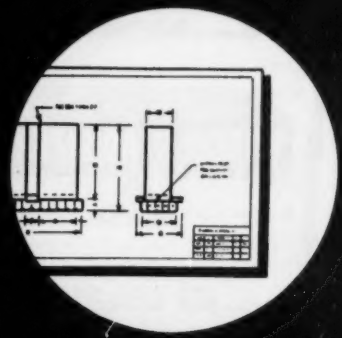
HAND-operated mixer, especially designed for use in preparing powdered skim milk, is molded entirely of styrene in an attractive two-tone color combination. The mixer, a product of Federal Tool Corp., Chicago, Ill., consists of three durable styrene parts—translucent container, cover, and mixing plunger—which will not rust, stain, or clog. When assembled, the unit stands only 11 in. high, and can easily be stored in the refrigerator. After use, the mixer can be cleaned in warm, soapy water.

In addition to mixing powdered milk, the device can be used for waffle batter, eggnogs, fruit juice concentrates, and similar liquids.

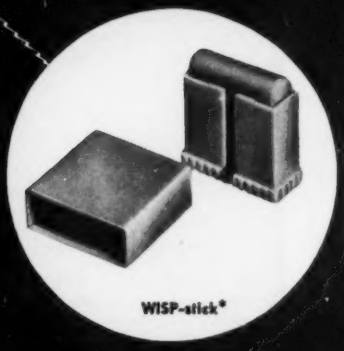
All three parts of 11-in. high, graduated mixer are molded of styrene



1. design



2. engineering



WISP-stick*

3. production

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The success of your plastic product may depend on any one of these three important steps: *design, engineering, production*—or the combination of all three.

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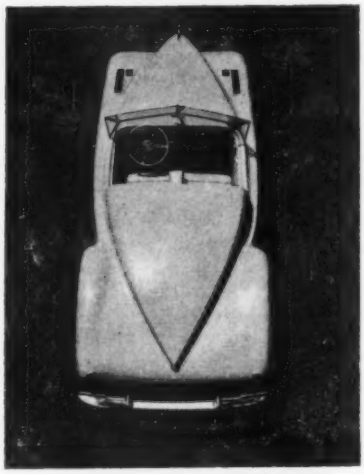
Sports Car Body is 16 Ft. Long

INTEREST among motorists in custom-made automobile bodies of fibrous glass-polyester laminates continues to grow—and the number of such bodies in commercial production continues to multiply at an amazing rate.

One of the latest entries in this new market is a sleek sports model being manufactured by Maverick Motors, Mountain View, Calif. The streamlined reinforced plastics body of the Maverick measures 16 ft. long and 6 ft. wide, yet weighs only 220 pounds. It is designed to fit any Cadillac sedan chassis, dating back to the 1936 model, and can also be adapted to fit Hudson, Packard, Buick, and Chrysler frames with a 120- to 128-in. wheelbase.

Except for the hood, the body is molded in one piece with no connecting panels or joints to break the sweep of its curves. Instead of a hinged trunk door, the seat cushions swing forward to provide access to the automobile's luggage compartment.

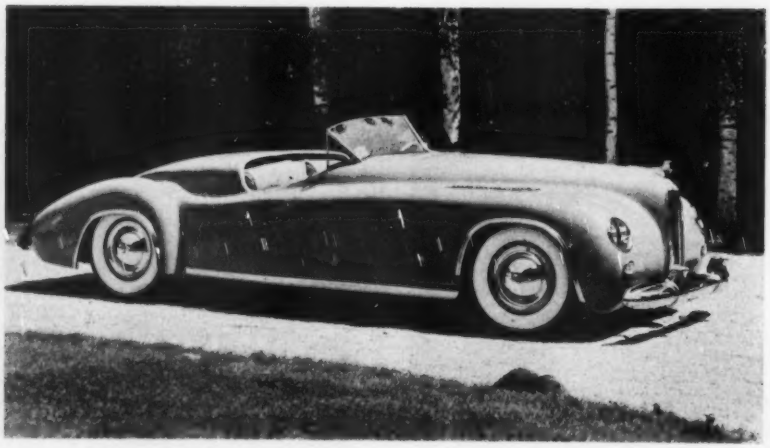
In the production of both the female mold and the plastics body, the reinforcing Fiberglas is impregnated with Astrolite compounds formulated from Bakelite polyester resins by Industrial Plastics & Chemicals, Oakland, Calif. The male master was built up of 1400 lb. of plaster formed over a framework of Masonite and steel tubing. When the plaster surface had been brought to a smooth finish, the female production mold was made on it by laying up impregnated cloth and mat.



Top view of car with one-piece body of fibrous glass-polyester laminate

Production of the final body is similar to that of the female mold. Parting agents and polyester resins are applied to the surface of the cured female mold and glass cloth or mat is laid on this surface, impregnated with polyester resins, and cured. After curing, the shell is attached to the chassis by four bumper brackets and two main body bolts on each end of the front fender. The body carries no accessories except lights and windshield; instrument panel and upholstery are integral with chassis.

Reinforced plastics streamlined sports car body is 16 ft. long, 6 ft. wide, and weighs only 220 pounds. Body fits any Cadillac sedan back to the 1936 model



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Wheelco Instruments

. . . control heat zones for low cost molding on new LEWIS "6"

The new Lewis "6" is a versatile injection molder combining big machine capacity with speed, economy, silent operation and compact construction of lightweight models. Wheelco Panelmount Capacitrols, conveniently mounted on a self-contained instrument panel, indicate and control temperatures in front and rear heat zones. Accurately maintaining proper control temperatures for each plastic material, they permit fast, profitable production of accurate, flawless moldings! Specify Wheelco Instruments for precise temperature control on your injection molding equipment. They give you fast response to translate temperature measurements into control action accurately. And you'll get prompt, efficient instrument service from your nearby Wheelco field office if, and *when* you need it!

Model 6E Injection Molding Machine, manufactured by The Lewis Welding & Engineering Corporation, Bedford, Ohio, is capable of plasticizing up to 60 pounds of polystyrene per hour, and has been used to mold shots of 6.8 ounces repetitively at the rate of 2½ per minute. The compact instrument panel, with Wheelco Panelmount Capacitrols, may be mounted on wall or stand next to machine.

Wheelco Capacitrols, standard of the plastics industry, precisely control critical temperatures for high quality plastic molding, extruding, and injection processes. With built-in Capaciline, they provide low cost proportioning control.

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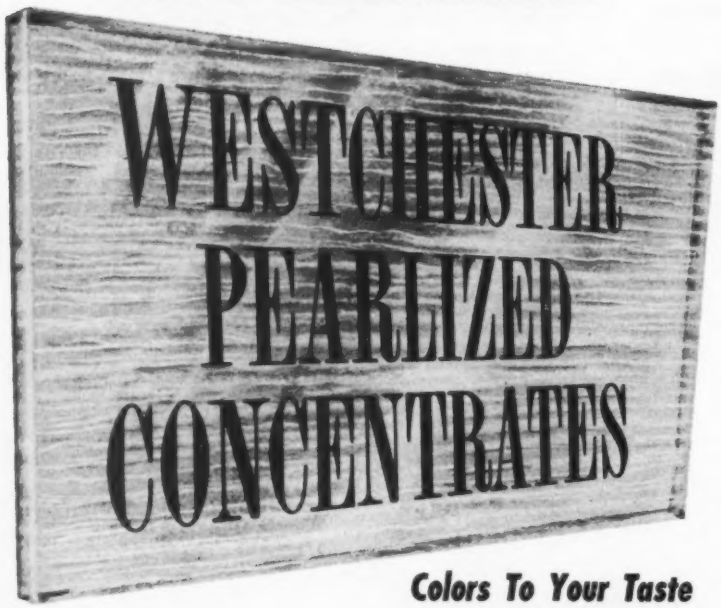

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Acrylic Partitions

DISTRACTING noises that hinder the efficient operation of an office force are greatly reduced by isolating individual desks behind acrylic partitions. Since the enclosures are transparent, the visibility of the worker is not restricted nor does the orderly appearance of the office suffer in any way.

Typical of the effectiveness of the application is the successful installation of the partitions in the want ad department of the *Fort Worth Star Telegram*, Fort Worth, Tex., where telephone orders are taken by a large office staff. To shield each ad-taker from the voices of neighboring employees, light weight sheets of clear Plexiglas were fabricated by Air Accessories, Inc., Ft. Worth, and mounted on the front and two sides of each desk top. Each sheet is drilled along the bottom edge for attachment to the desk. To join the three individual sheets together, holes are drilled along the side edges and metal angle brackets are used.

Because of the strength and the resiliency of the acrylic, the partitions, once installed, withstand accidental blows.

As a further means of assuring the privacy of the workers, specially designed mail baskets, also fabricated of transparent Plexiglas, were installed in the top right hand corner of each enclosure. The baskets were mounted at a point high enough so that messengers coming down the aisle can easily spot which baskets have outgoing copy and can pick up the material without interrupting the ad-takers in the performance of their tasks.

Clear acrylic sheet lowers noise level —but not visibility—in busy office

NOW! SAVE ON SET-UP TIME!

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MACHINE ANGLES, DRAFTS or RELIEFS ***TOPS*** **IN SMOOTH CUTTING PERFORMANCE**

WITHOUT TILTING THE MACHINE HEAD OR THE WORK PIECE!

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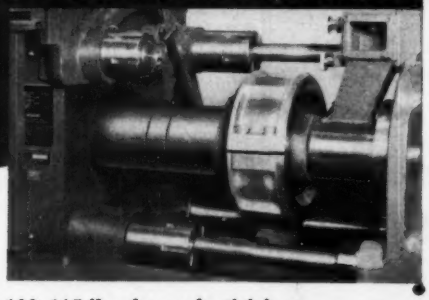
High-Plasticizing · Maintenance-Free

REPLACEMENT HEATING CYLINDER for 10D-8 oz. Injection Machines



- 100–115 lbs./hour plasticizing
- Ceramic heating elements included
- Quick field installation
- No new mounting equipment needed

For 1942-52 models — 10D-8SA Heater	$875.00
For 1953 models — 10D8-SB Heater	995.00

More plasticizing...faster cycles...higher quality parts

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LOW PRESSURE LAMINATES WITH SUNFORM PRE-IMPREGNATED GLASS

SUNFORM is glass cloth impregnated with polyester resin plus catalyst ready for immediate forming. It unrolls like a roll of paper.

SUNFORM OFFERS YOU-

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- STRONG BOND
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Yes indeed, with SUNFORM you'll really save time, labor and material — and get a superior laminate. Use SUNFORM for all types of molding.

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Our technical staff will be glad to help you with any forming problem . . . immediate service . . . no obligation.

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A staff of competent personnel will formulate and engineer a coating to meet your needs. We are also converters with facilities to apply coating to either fabric or paper.

REYN-O-SOL is a vinyl plastisol that has been proved outstanding as a protective coating. It has great physical and chemical resistance properties and can be furnished in a variety of colors.

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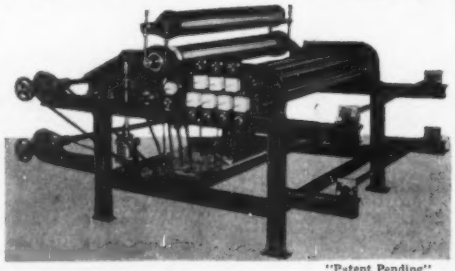

"Patent Pending"

This moderately priced machine, for all gauges of vinyl, has an operating face of 62", and is capable of handling material up to 60" in width. We will gladly supply full details. LIBERTY MACHINE CO., INC. 275 Fourth Avenue, Paterson 4, New Jersey.

Write for Liberty's complete catalog of film processing equipment.

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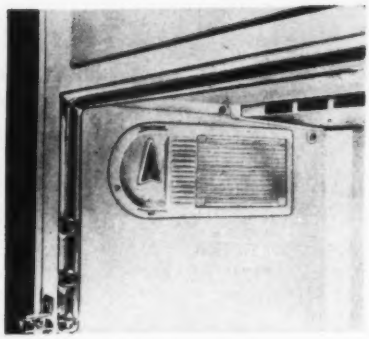


Molded urea light housing recesses fully in refrigerator side wall

Light Housing

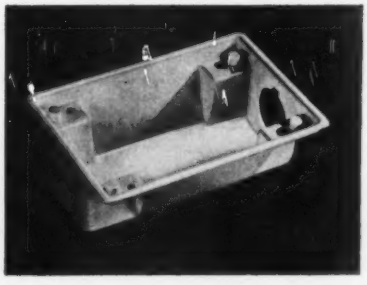
AN AUTOMATIC interior light, recessed in the sidewall of the 1953 Philco refrigerator and housed in a molded urea case with a translucent styrene cover, offers a new concept in refrigerator lighting.

Since the front of the rugged urea housing is flush with the wall, the light bulb is completely out of the way of any possible harm, yet illuminates the entire interior of the refrigerator through the translucent styrene cover fastened to the front of the housing. In addition to protecting the bulb, the urea housing provides a good insulating barrier that helps maintain the low temperatures necessary for preserving fresh foods.

The housing is molded of Beetle urea by General Industries, Elyria, Ohio, with a hole and a boss in each of the four corners to facilitate the installation of the part in the sidewall of the refrigerator.

The unit is available in a wide range of colors that will not chip off, and its smooth surface can easily be cleaned without danger of rust.

Hole and boss in each corner of light housing facilitate final installation



Sprayed Plastics

(*Continued from pp. 93-98*)

blocks to prevent particles from being shaken loose by the vibration of machines.

In addition, plastics coverings can be sprayed on the old canvas decks of yachts as a combined waterproofing and decorative coat; they can keep porcelain plumbing fixtures clean during painting or building operations; they can protect pipe from corrosion; they can be used on spray booth walls to minimize the need for scraping off heavy paint deposits . . . and the list goes on and on! The only limit appears to be the imagination of the end user.

There is, however, one application for sprayed-on vinyls that deserves special mention. Since mankind stands today on the threshold of an atomic era, the special ability of the vinyl film to reduce penetration of radioactive radiation into the surface to which it is applied takes on added importance.

Already, the material has been put to use by the Atomic Energy Commission. Much of the information about these applications remains classified, but it can be reported that sprayed-on plastics are used for coverings in the stalls of animals being subjected to experimental radiation. At the conclusion of each experiment, the film containing the radioactive material is stripped from the walls and a fresh coat applied.

It is also known that research is being conducted on pigmenting the sprayable film with a lead powder. A formulation of this sort can be sprayed on the inside and outside surfaces of buildings, on machinery, on military equipment, or even on the clothing of GIs, as a protective lining in the event of an atomic attack.

The Future

The background and the current applications of sprayed-on plastics only hint at the future. There are many potential uses that have not as yet even left the designer's drafting board—but each, as soon as it is developed, will find a ready market.

One such application that excites the imagination is the manufacture of an attractive, durable fabric by spraying liquid vinyl on an en-

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Every Electro Dynamic motor is built with
EXTRA INSULATION in stator slots and between phases
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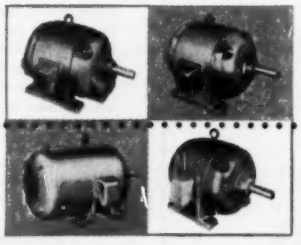

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Extra large "free-flo" air channels.

Permanently aligned cast iron brackets.

Liberal size grease lubricated bearings.

Also a complete line of Direct Current motors and generators

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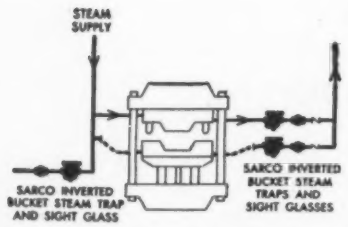
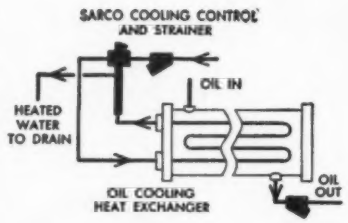
Traps • Strainers • Temperature Controls

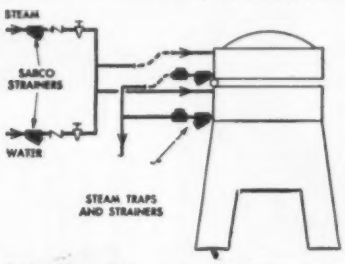
...for more efficient operation of your plant equipment



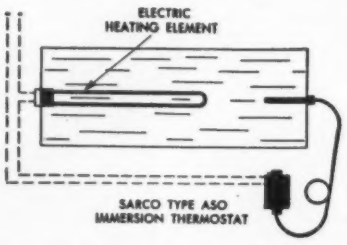
Compression molding press fitted with Sarco Inverted Bucket Steam Traps, the blast discharge of which scours the heating surface of the platens.



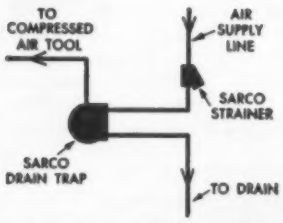
Heat exchanger cools hydraulic oil of plastics molding machines. Temperature of the cooling water is regulated by the Sarco Cooling Control.



Sarco steam traps on a steam-heated and water-cooled molding press.



Annealing bath temperature controlled by Sarco type ASO electric immersion thermostat.



Sarco Type F.A. trap draining small line to compressed air tool.

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Inverted Bucket Traps 360
Compressed Air Drain Traps ...520
Cooling Controls 700
Type ASO Electric Thermostats ..1000
Pipe Line Strainers ..1200 and 1225

Need help with your process heating equipment? Sarco can show you how to improve the output of your steam heated machines — cut your steam costs. Our years of specialized experience in the manufacture and application of traps, strainers and temperature controls are at your service.

Send us a sketch of your hook-up problem, we'll check it and send you our recommendations without cost or obligation.

SARCO COMPANY, INC.

EMPIRE STATE BUILDING, NEW YORK 1, N.Y.
SARCO CANADA LTD., TORONTO 8, CANADA

graved, embossed, or textured surface. When stripped off, the film can be used as a handsome three-dimensional covering for luggage and similar items.

Another possibility is a sprayed-on plastics top for convertible automobiles. Designer Rothenstein foresees such tops being made by spraying the film onto a metal mold which can be embossed with a texture and shaped to the contours of the top. When a desired thickness is reached, the spraying is stopped and a layer of a reinforcing membrane is placed over the sprayed-on sheeting. The spraying would then continue. The finished top, when stripped off the mold, is ready to mount on the car without any additional cutting or fitting.

A third possibility is in the packing of "hard goods," such as refrigerators, radios, air conditioning units, etc., for delivery from showroom or storage space to the ultimate consumer. A protective covering of sprayed-on film to prevent abrasion and protect the product against surface scratches, plus a paper-board container, may provide greater security at lower cost than the traditional higher-cost shipping containers and liners. Where goods are to be on display before delivery, the protective film may be tinted to complement the underlying color of the product.

Growing Pains

Despite the tremendous gains that have been made in the industry in only a few years, the spraying technique as applied to the strippable plastics film or sheeting is still in the throes of growing pains.

As more and more end users become familiar with the techniques and potentialities, it is logical to assume that other industries will find a place for sprayed-on plastics in their operations.

One manufacturer interviewed in the course of this survey put it this way: "Every day at least five new ideas come up for applying the material. I am not exaggerating when I say I could list several hundred possible uses of vinyl sprayed-on coverings and at least another hundred possibilities on which we are currently working."

The horizons are almost limitless. Sprayed-on plastics are well on their way.—END

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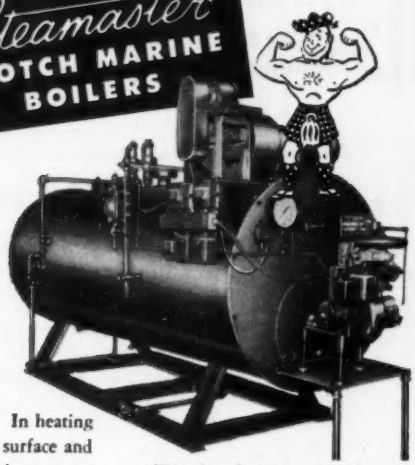

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Write Dept. P., Stoughton, Mass.

BROOKFIELD ENGINEERING LABORATORIES, INC.

Plastic Portable

(*Continued from pp.* 104-105)

ing plug while the phonograph is being carried. To the upper right of the turntable is a deeper and wider horizontal slot for the plastic conversion disk for 45-r.p.m. records.

Also molded-into the board is a raised speaking grille located directly over the speaker. This grille consists of a series of parallel rectangular projections open at two side ends and on the bottom. According to the manufacturer, the use of plastics for this particular part has not harmed the tone quality of the machine in any way; rather, it has been enhanced.

Assembly

In the assembly of the unit, the initial step is to attach the handle and the chassis to the motor board. The lid of the case is then secured to the board by a simple hinge arrangement that permits it to swing back and forth.

This hinge is formed by first press-fitting two small metal rivets into molded-in holes on either side of the extended rear section of the lid. The rivets are then inserted into molded-in slots at the rear of the motor board where they can rotate freely.

As the final step in the assembly, the motor board, with lid attached, is screwed into the base of the case. Since two of these screws are located to the rear of the board adjacent to the slots in which the metal hinge rivets rotate, they also serve to hold the rivets in place and prevent them from slipping out.

On the basis of the enthusiastic response that has greeted the introduction of the new phonograph, Sonic Industries has predicted that the unit will be the forerunner of a new trend in the use of plastics in portable phonographs. Light in weight, easy to work with, and colorful, plastics materials offer more flexibility in the design and construction of phonograph housings than would be possible with wood or metal.

The large volume of plastics going into similar housing applications in a companion field—the portable radio industry—is indicative of the important potential market for plastics in portable phonographs.—END

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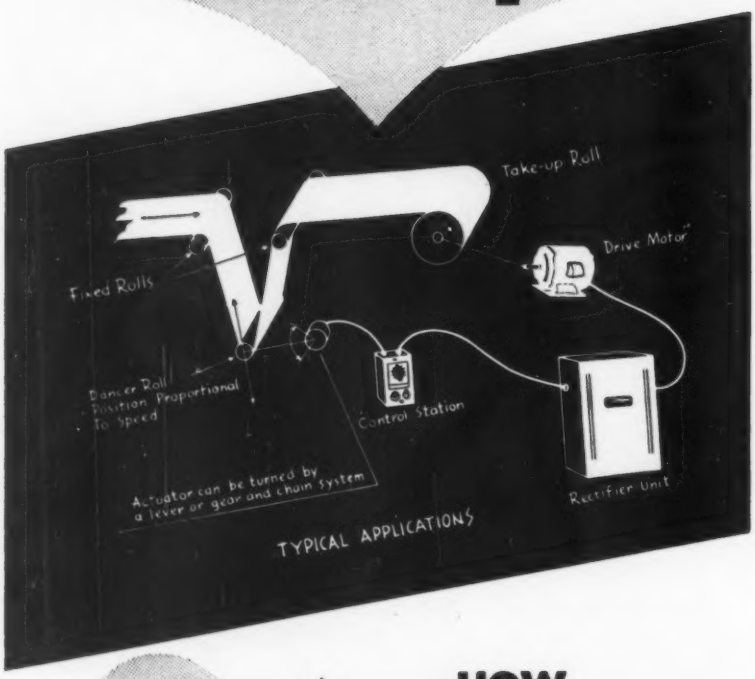

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WRITE

Servospeed

4 Godwin Ave. Paterson, N. J.

Safety Helmet

(*Continued from p.* 103)

comfortably on the head of the wearer, suspended by the interior hammock-like assembly consisting of the flexible vinyl headband, an adjustable leather strap, and a short length of cord looping the extended flaps of the headband together. The ample space thus left between the hat shell and the head provides an extra margin of safety and allows air circulation.

Two styles of vinyl headband suspensions are available—a regular and a "buffer" type—both of which are basically designed to minimize shock and to rest comfortably on the head. The "buffer" type is molded with an extra series of fin-like projections that serve as added protection against side impact. The regular type, which does not have the fins, has the advantage of being 1 oz. lighter.

Since the shell of the hat is injection molded in one piece, there are no seams or joints to weaken it. Moreover, the vinyl headband, being attached directly to the inside rim of the shell, needs no external laces, holes, or rivets to keep it in place. This unique attachment is accomplished by molding six slotted suspension points directly into the inside rim of the shell and six projecting "keys" around the outer perimeter of the vinyl headband. The headband is held firmly in place by simply slipping the "keys" into the slots.

Despite its light weight of only 15 oz. (with "buffer" type headband), the helmet has successfully met—and in some cases exceeded—required standards for impact resistance, pierce resistance, and dielectric strength.

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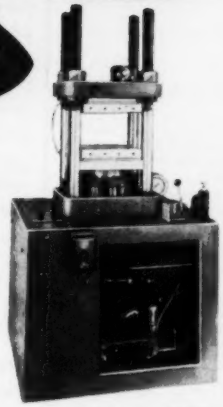

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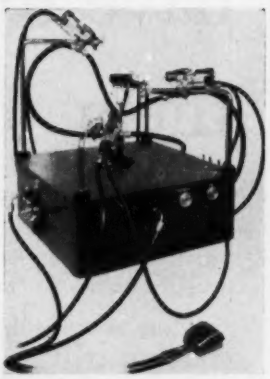

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Plasticizers

(*Continued from pp.* 116-120)

should be tested at a designated low temperature for cold-crack resistance. After compounds are prepared which are acceptable on both of the above properties, differences in resistance to "rub-off" may be measured. In this manner the relative merits of octyl phthalates, low-temperature plasticizers, resinous plasticizers, phosphates, and mixtures thereof may be more critically examined.

Calendered vinyl flooring products may be considered as a subdivision of vinyl sheeting. They represent one of the brighter prospects for increased sale of plasticizers over the next several years. Laminated continuous flooring, resilient tile, and vinyl asbestos tile are the three chief types of calendered vinyl floor coverings. Continuous flooring compounds and resilient tile generally contain from 40 to 50% of resin and plasticizer while vinyl asbestos tile may contain from 30 to 35% resin and plasticizer. Fillers, stabilizers, and pigments account for the remainder. Continuous flooring products consist of 20- to 25-mil sheets laminated to an asphalt saturated felt base backing.

Resilient tile is based on a formulation similar to that used for continuous flooring. The plasticizers used are generally limited to such materials as tricresyl phosphate, di-2-ethylhexyl phthalate (DOP), alkyl aryl phthalates such as butyl benzyl phthalate and high solvating specialty plasticizers such as diethylene glycol dibenzoate. The latter is used almost exclusively for flooring materials because it can be processed at low temperatures.

There is somewhat greater latitude of formulation in vinyl asbestos tile where some quantities of non-volatile extender types of plasticizers such as alpha methyl styrene resins or chlorinated paraffins may be used in conjunction with the octyl phthalate type plasticizers.

No attempt has been made here to present an exhaustive study of the philosophy of plasticizer choice as applied to calendered film and sheeting. Rather, the aim has been to indicate where each type of plasticizer may be used and for what reasons.—END

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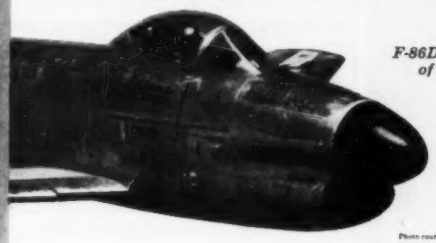

The radome on the F-86D Sabre Jet is but one of countless production parts fabricated of Hexcel Honeycomb.

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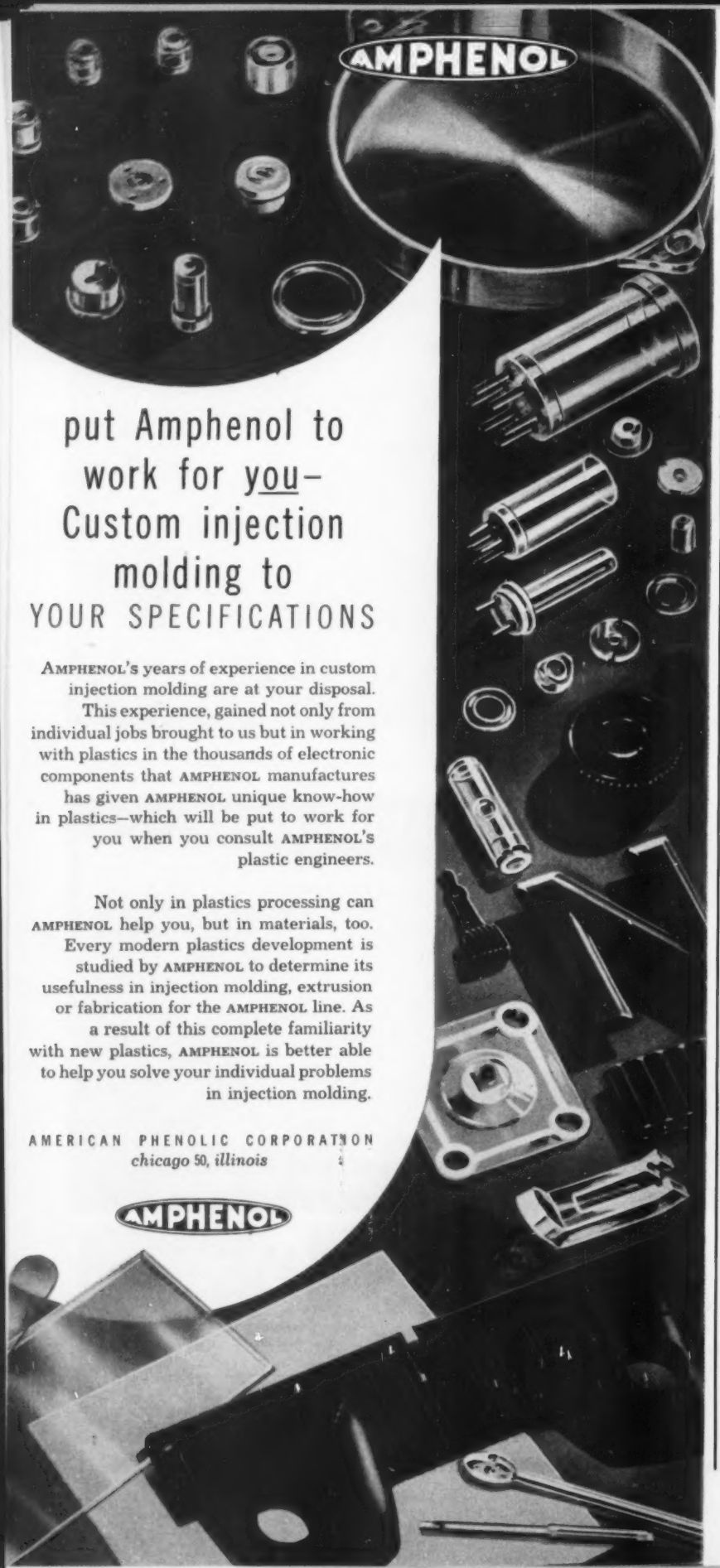
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Meetings

(*Continued from p.* 121)

is composed of representatives of 7 countries; as follows: chairman, M. V. Potter, United Kingdom; vice chairman, Pierre Dubois, France; secretary, G. M. Kline, United States; R. Houwink, Netherlands; Jean de Laire, France; Giulio Natta, Italy; B. Berndtsson, Sweden; and R. Vieweg (resigned, to be replaced), Germany. As a result of the discussions at the Stockholm meeting, subcommittees were set up to prepare 1) a draft proposal for a simplified technical classification of plastics and high polymers and 2) a review of qualitative chemical identity tests for plastics and high polymers.

The I.U.P.A.C. Macromolecular Commission met in Stockholm under the chairmanship of Dr. H. F. Mark, Brooklyn Polytechnic Institute. This group is working on four projects, namely: 1) nomenclature in the field of macromolecules (see J. Polymer Science *8*, 257, Mar. 1952); 2) standard polystyrene sample for use in determination of molecular weights and other molecular structural properties of macromolecules; 3) compilation of a list of laboratories in various countries working on the fundamental properties of macromolecules; and 4) documentation of information on macromolecules. The other U.S. members of the I.U.P.A.C. Macromolecular Commission are P. Doty, Harvard University; Paul Flory, Cornell University; and Emil Ott, Hercules Powder Co. This Commission plans to hold its next meeting in September, 1954.

I.U.P.A.C. Congress

The International Congress of Pure and Applied Chemistry held at the Royal Institute of Technology, Stockholm, was attended by about 2000 chemists, of whom approximately 150 were from the United States. Two symposia were featured on the program: 1) a Symposium on the Chemistry of Wood and Wood Constituents, under the chairmanship of Prof. Erik Hagglund, Swedish Forest Products Laboratory; 2) a Symposium on Macromolecules, held in the historic university town of Uppsala, under the chairmanship of Dr. H. F. Mark, Brooklyn Polytechnic Institute, and Prof. Sig Claesson, University of Uppsala.—END

Restricted Gating

(*Continued from pp.* 125-130)

stepped down 0.010 in. on the other.

Molding conditions currently used are 345 to 350° F. cylinder temperature, 500° F. nozzle temperature, and 18,000 p.s.i. injection pressure. Total cycle is 62 sec. with a 40 sec. dwell. A 16-oz. H-P-M- injection molding machine is used.

The restrictions were originally made by welding shut the open runners at each point and cutting the restrictions in the weld. Once the success of the restricted gating was established, a more permanent setup was made by inserting hardened steel plates in the runners and cutting the restrictions in the plates. The molder reports that even with the hardened steel plates the original scratched restrictions are deepened sufficiently after several weeks' operation that the plates must be machined smooth and the scratches cut in again.

Restricted Gating Principles

Some general principles of re-restricted gating for Vinylite elastomers can be proposed based on the work described above. 1) The gate must be considered as not only the immediate entrance to the mold cavity, but to include the runner area near this entrance as well. 2) The runner to each cavity should be full round, normally ¼ in. in diameter, and interrupted by a restriction approximately ¾ in. from the entrance to the cavity. This restriction should be 1/16 in. long and 0.015 in. or less in diameter. The restriction should be centered in the runner. There should be no streamlining of the runner at the restriction. 3) A pin ⅛ in. in diameter should be placed in the runner between the restriction and the cavity. This pin should be 0.100 in. from the restriction. 4) The actual entrance into the cavity should be flush with the cavity on one side and stepped away 0.010 in. on the other side. This entrance should be at least ¼ in. wide for moderate sized pieces.

Acknowledgment

The guidance and constructive suggestions offered by G. G. Himmler, Bakelite Co., during the course of this work were of great assistance.—END

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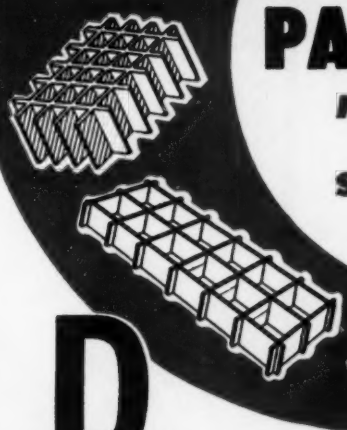

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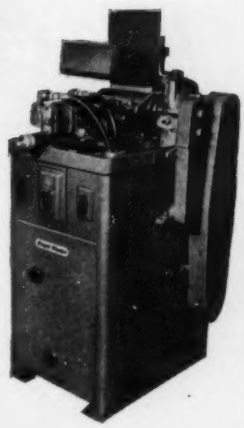

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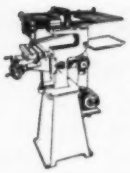

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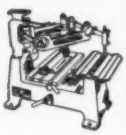

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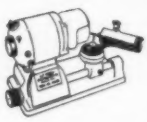

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Allyl Resins

(*Continued from pp.* 139-144)

mold lubricant is required; if materials such as plaster of paris are used, a simple lubricant such as mineral oil will suffice. Milling operations such as turning, sawing, grinding and polishing are very easily performed with allyl castings, even where these operations generate considerable heat. The infusible nature of the allyl combined with high strength characteristics, permit these operations to be conducted with conventional shop machinery. There is little or no tendency to fuse, gum, or stick, a common failing with the usual clear casting.

Heating during the casting operation may be accomplished in several ways. Air-ovens and heated platens are generally applicable. Infra-red heating is suitable with diallyl phthalate which absorbs very strongly in this region of the spectrum, but dielectric heating is ineffectual. Radio-frequency field heating is useful in molding operations where α-cellulose is used as filler.

Pro's and Con's

The pro's and con's of allyl castings related to manufacture and use can be listed as follows:

Advantages

High chemical and solvent resistance.

Excellent abrasion and mar resistance.

Little tendency to distort or develop surface cracks in heating and forming operations; not easily damaged by over-heating in air-ovens.

Craze resistance under stress is high.

High weather resistance and clarity in the product.

Does not exhibit optical creep; very photoelastic.

Infusible character facilitates shop practice operations in finishing.

Cure by addition polymerization is a major asset.

Disadvantages

Does not lend itself to deep drawing.

Tendency toward brittleness at notches.

High shrinkage in some allyls complicates casting.

Some tendency toward loss of

Furnished in rolls or sheets as specified

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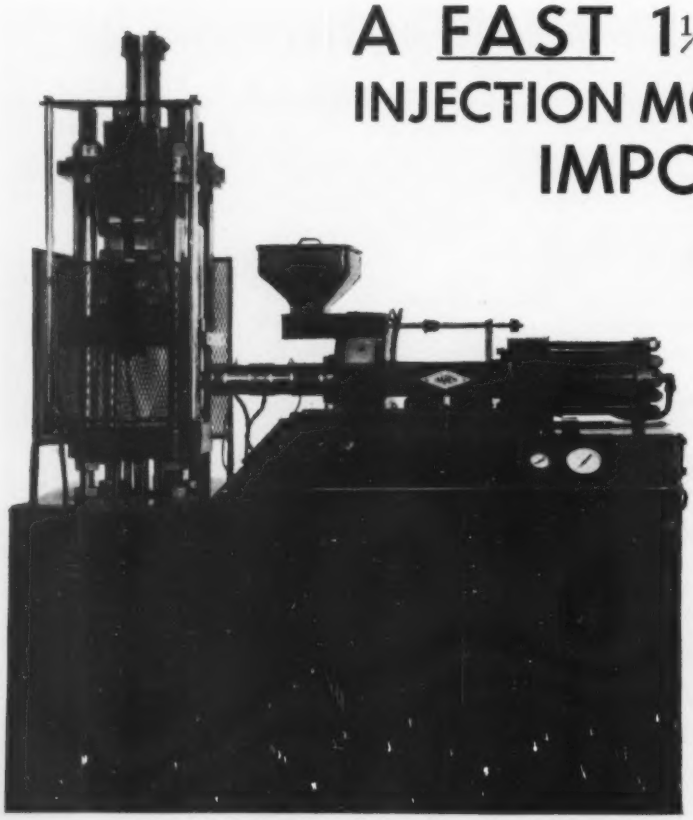

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SPECIFICATIONS:

Injection Capacity—1½ to 3 Ounces
Injection Pressure (Plunger)
21,200 lbs. p.s.i. (1½ Ounces)
16,000 lbs. p.s.i. (2 Ounces)
6,530 lbs. p.s.i. (3 Ounces)
Clamping Pressure (Fast Action) 50 Tons
Clamping Stroke—6 Inches
Auxiliary Compression Cylinder—5 Tons
Compression Stroke—4"
Mold Space between Tie Rods—8½ x 8½
Machine to Cycle (Dry Run)—10/minute
Dimensions—76" long—32" wide—95" high

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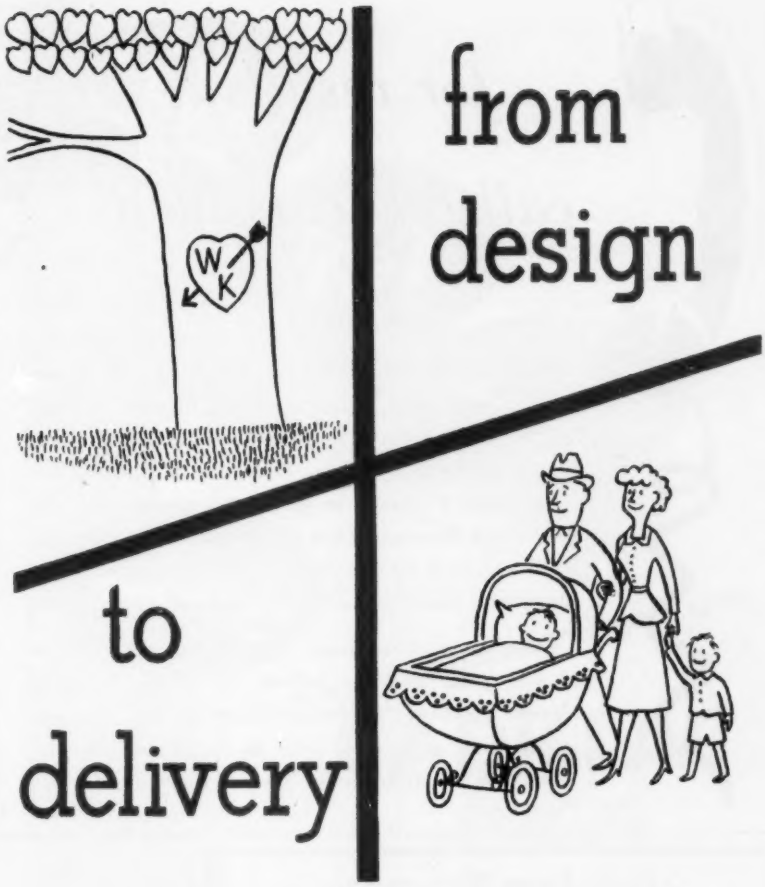
curvature in formed sheet stock, especially when large; may require light frame supports. . .

Molding operations are not complex and can make good use of the allyl pre-polymers. Compression, injection, or in particular, jet techniques may be easily used. The molding powder may be prepared by several methods, among them two general techniques. All ingredients of the final powder may be mixed directly on a rolling mill in the direct preparation. A more convenient method involves preparing a powder base, an uncolored mixture of the molding powder materials, which is dried to remove solvents and stored to provide a stock for plastics of various colors. The powder base (37) may be prepared as follows: 1) mix the filler and release agent in a dough mixer, 2) add the resin mixture, e.g., 50% acetone, 50% pre-polymer plus catalyst, and mix, 3) dry to remove the acetone, and 4) grind the dry product to the proper size for post-pigmentation milling.

The pigments required for the color shades desired are added before the final milling, which may be done with two rolls, the hot one at 90 to 95°C. and the cold one at 30 to 35°C. Average milling time should be about 3 min., but the feel of the material and the standard cup test are a better guide to proper milling than any fixed time rule. A typical molding formulation (35,37) requires 55 lb. of acetone, 55 lb. of diallyl phthalate prepolymer, 90 lb. of α-cellulose, 1.5 lb. of calcium stearate, 2 lb. of catalyst, and any pigment desired.

Other Applications

Miscellaneous uses for the allyl resins include the preparation of cross linked resins, e.g., making a thermosetting resin with normally fusible vinyl acetate by adding a small amount of diallyl succinate to the polymerization kettles. Also of note are flameproofing with allyl-phosphorus compounds (47) as co-polymers, the preparation of polymeric lubricants from allyl halides (11), and the preparation of adhesives and coatings from allyl sucrose and glycolates (16, 20, 54). An interesting potential use for the allyls involves their application to softer plastics (35), such as methyl methacrylate, as either a surface coating



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or copolymer in order to improve the solvent, scratch, and heat resistance of the product. All of these uses are still largely developmental in nature, but successful development could lead to high tonnage uses.

Allyl Resin Properties

The examples selected to demonstrate allyl resin properties are fairly typical. In Table I the properties are those of a clear casting

Table I—Physical Properties of Cast Allyl Resin (3)

Specific gravity (25/4°)	1.31
Refractive index ($20/n_D$)	1.50398
Rockwell hardness	M95-M100
Tensile strength, p.s.i.	5000-6000
Flexural strength, p.s.i.	8000-10,000
Compressive strength, p.s.i.	22,800
Impact strength, Izod, notched, ft.-lb./in.	0.3-0.4
Impact strength, Izod, unnotched, ft.-lb./in.	2-3
Specific heat, cal./g. °C	0.55
Thermal expansion, linear, per °C, at 10°C.	0.000087
Light transmission, %	90-92
Haze, %	1-2
Water absorption, %	0.2-0.4
Power factor at 1 kc.	0.012
Power factor at 1 mc.	0.057
Dielectric constant at 1 kc.	3.8
Weight gain, 7 day immersion in water, %	0.7
Operating temperature, continuous, max., °C.	100

Table II—Properties of a Fortisan-Diallyl Phthalate Laminate (35)

Assembly of plies	Crossed
Specific gravity	1.29-1.41
Resin content, %	59-61
Tensile strength, p.s.i.	14,300-19,600
Tensile modulus of elasticity, 10^6 p.s.i.	1.2-1.4
Elongation, %	3-3.5
Compressive strength, p.s.i.	19,000-26,400
Compressive deformation, %	8-10
Impact strength, Izod, notched, ft.-lb./in.	10.1-11.4
Barcol hardness	45-52
Rockwell hardness	M101-M103
Heat distortion temperature, °C.	160-175
Gain in weight after 24 hr. in:	
Water, %	0.5
Acetone %	1.0
NaOH, 1%, %	0.6
Benzene, %	0.5

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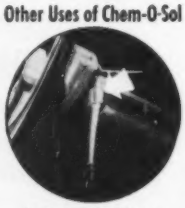
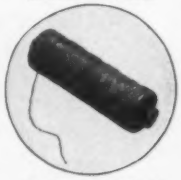


Material for Gear Shift Lever Cover



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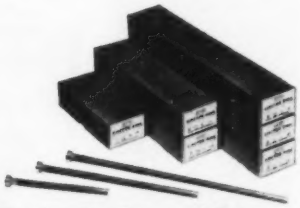

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made from an allyl glycol carbonate (3). Allyl laminates are characterized by the Fortisan diallyl phthalate plastic of Table II (35). The molded plastic properties of Table III are based on the use of a 50% acetone—50% diallyl phthalate solution (37). It must be stressed that these properties are average properties. Recent advances have led to more outstanding plastics not yet in general use. An example is a laminate (17, 18) made from a copolymer of triallyl cyanurate and a maleic alkyd which is heat resistant up to 500°F. This laminate exhibited flexural strength of 30,000 p.s.i. after 24 hr. continuous exposure to 500°F. It is reasonable to believe that further similar advances will be made by the allyls in plastic applications other than the laminates.

Table III—Properties of a Diallyl Phthalate Molded Plastic (37)[a]

Mold shrinkage, in./in.	0.002-0.008
Specific gravity	1.35-1.40
Tensile strength, p.s.i.	7,000-12,000
Compressive strength, p.s.i.	25,000-33,000
Flexural strength, p.s.i.	10,000-14,000
Impact strength, Izod, notched, ft.-lb./in.	0.25-0.35
Rockwell hardness	M102-M109
Heat distortion temp., °C.	130-155
Dielectric strength, ⅛ in., v./mil	350-400
Dielectric constant at 1 kc.	4.5-5.0
Arc resistance, sec.	80-130
Water absorption, 24 hr., %	0.1-0.8

[a] The filler used in the molding powder was alpha-cellulose.

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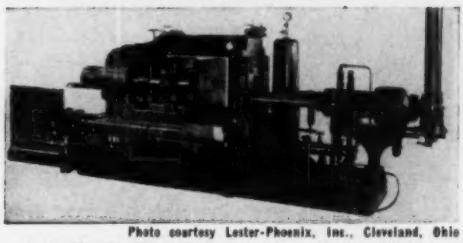

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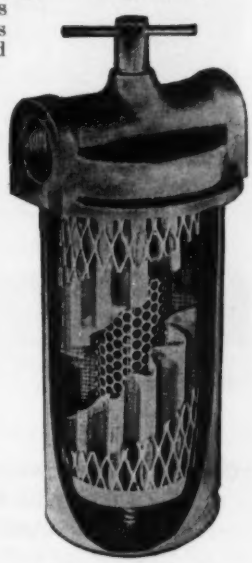

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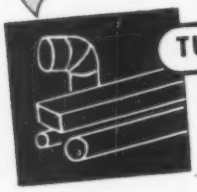

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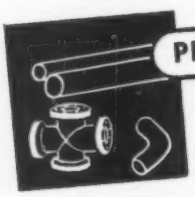

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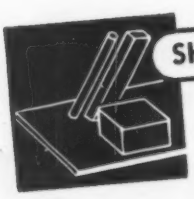

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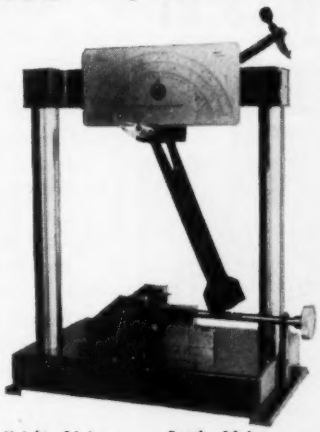

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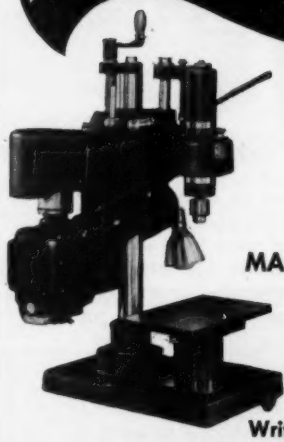

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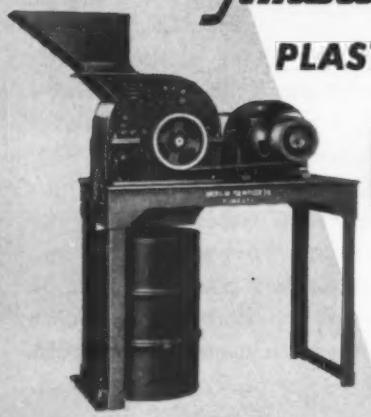

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—END

Melt Flow

(*Continued from pp.* 146-150)

The results of this test indicated reliabilities (at the 95% confidence level) of about ±10% for the average of two determinations. In individual locations, with very close control conditions, reliabilities of ±5% for single determinations have been maintained for long periods.

Volumetric Measurement

The melt indexer may be adapted to volumetric measurement of flow rate by the addition of a dial gage to measure piston travel. The dial gage is attached to the upright panel with the foot of the gage resting on the upper end of the piston as shown in Fig. 6, page 150.

A dial gage which is graduated in 10^{-3} in. and with a stroke of 2 in. is adequate for most measurements.

Volumetric measurement of flow rate has several advantages. The weighing step may be eliminated with a significant saving of time. Volumetric measurements can be used under shop conditions which prohibit the use of analytical balances. Gravimetric and volumetric data taken simultaneously permit the calculation of melt density. This method has proved remarkably simple for obtaining melt density as a function of temperature.

Volumetric flow rates in terms of in.-per-min. piston travel may be converted to grams flow per 10 min. by multiplying by a factor involving the density of the sample at the temperature of extrusion. The factor is 13.6 at 190° C., and 14.4 at 125° C. for polyethylenes.

Appreciation is expressed to Mr. T. H. Uhrig, instrument maker at the Du Pont experimental station for his large share in the success of this work and to Miss Mary T. Dunleavy for analyzing the data.

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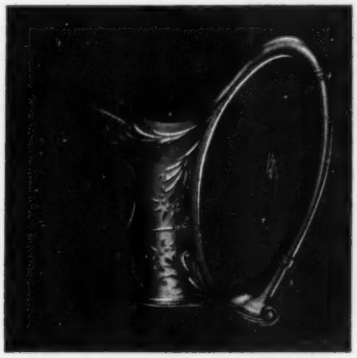

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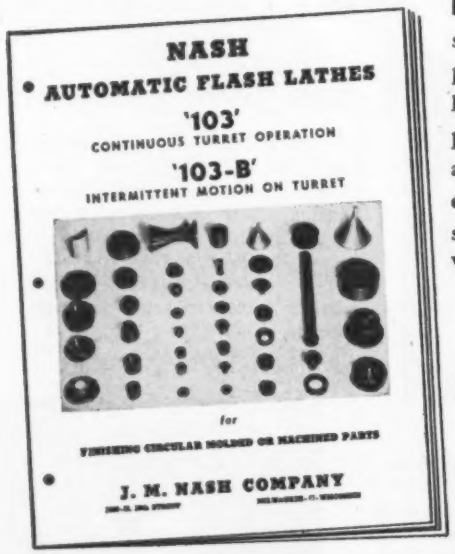

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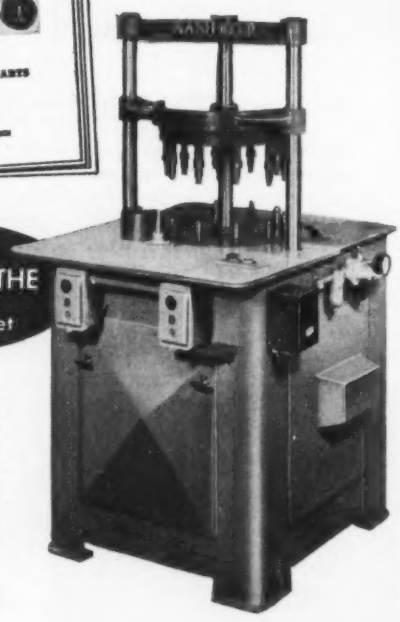

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State of New York
ss.
County of New York

Before me, Notary Public in and for the State and County aforesaid, personally appeared Charles A. Breskin, who, having been duly sworn according to law, deposes and says that he is the Publisher of MODERN PLASTICS and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the act of August 24, 1912, as amended by the acts of March 3, 1933, and July 2, 1946 (section 537, Postal Laws and Regulations), to wit:

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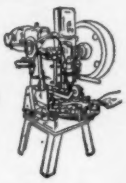

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THE PLASTISCOPE*

NEWS AND INTERPRETATIONS OF THE NEWS

By R. L. Van Boskirk

More Epoxy

THE latest word on Shell Chemical Corp.'s new glycerin plant at Norco, La., where epichlorohydrin and allyl chloride will be produced as co-products, is that construction has started and is scheduled for completion in 1954. The company's yearly glycerin output will be increased by 25 million pounds. No figures have been announced on the amount of epichlorohydrin that will be forthcoming. Whatever the amount may be, a good portion is ticketed for shipment to Shell's Houston plant where it will be used with bisphenol for the production of Epon (epoxy) resins. Epichlorohydrin is reacted with bisphenol in an average proportion of 0.8 lb. of bisphenol to 0.4 lb. of epichlorohydrin to obtain 1 lb. of epoxy resin.

For a resin that costs from 60¢ to $1.25 a pound and at present is limited to an estimated production of less than 10 million lb. of solid resin a year, epoxy has created an unusual amount of interest. Its outstanding properties of chemical resistance, flexibility, adhesiveness, toughness, and negligible shrinkage make it extremely attractive for many purposes despite its cost. In surface coating materials, such as varnishes, paints, and enamels, the resin cost is nullified because epoxy can be used with low-cost oils such as tall, soybean, and linseed instead of the higher priced quick drying oils. These coatings account for by far the largest share of epoxy resins produced today, but the use of epoxy adhesives and potting compounds is steadily growing. Furthermore, the use of epoxy resin with fibrous glass has already contributed some unusual features to the resin-glass business—one of them is the system for repairing damaged pipe developed by the U. S. Navy.

Use of epoxies with barium and cadmium for stabilizers is another growing application, and its use with soybean resins, as mentioned in another column of this department, is an indication of how chemists and technicians are working with epoxies in practically every laboratory where plastics are a subject for consideration.

No one is expecting that epoxy production will soon zoom to such heights as vinyls, polystyrene, and other big-volume materials, but various chemical companies certainly seem to believe that its future is good enough to warrant the investment of hundreds of thousands of dollars in production facilities. In addition to the abovementioned Shell expansion and a reported doubling of capacity soon by Ciba, it is stated that two more chemical companies will have epoxy resins ready for distribution in commercial quantities in the not too distant future.

The Bakelite Co. has already started construction of a new plant at Bound Brook, N.J., for production of epoxy resins. It should be ready for full-scale production by the middle of 1954, if not sooner.

The Dow Chemical Co. is also a more than likely prospect to enter the field. That company has made no official announcement but has received a $5½ million Certificate of Necessity to build a synthetic glycerin plant, and guessers assume that the company will produce epichlorohydrin as a co-product. Since Dow is already the only announced producer of bisphenol on a commercial scale and has received a Certificate of Necessity to enlarge this capacity, it would seem natural to believe that it too will eventually get into the epoxy business.

At the present moment, these three companies are closely interrelated in the production of epoxies, but that situation will no doubt change within a few years' time. Shell, for example, must now buy bisphenol from Dow, but has let it be known that they are building a bisphenol plant in Houston. Bakelite must supposedly now buy epichlorohydrin from Shell and bisphenol from Dow, but it is also probable that Bakelite, or one of its associate divisions, is capable of producing all the raw materials from which epoxies are produced and will not remain forever dependent upon other companies for its raw material supply. How long it will take to knit all these factors together so that there will be three or four producers of epoxy resins, all independent of each other insofar as raw material supply is concerned, is uncertain. The more certain factor is that by the end of 1954 there will probably be at least three or four times more epoxy resin capacity available than there is today.

Polyester Rubber

FOR the benefit of readers in the plastics industry who will be interested in Goodyear's polyester rubber because of its close kinship to plastics and the possibility that it may compete with certain plastics products, we refer them to Goodyear's recently published booklet, "Miracles of Research." It may be obtained from The Goodyear Tire & Rubber Co., Akron, Ohio.

The new polyester, called Chemigum SL, is claimed to have already demonstrated its superiority over existing rubbers for tire treads and gives promise of similar results in shoe soles, floor coverings, and industrial rubber products. Still another new field is seen in the use of this polyester as a coating for rubber and plastics articles to protect them against deterioration by oxidation and sunlight.

The tensile strength of Chemigum SL is 50 to 100% better than any other rubber-like material and its resistance to oxidation is superior to that of natural or GR-S synthetic rubber, where it is in a class with such synthetic rubbers as butyl and acrylate.

The basic ingredients used in its manufacture are glycol and propylene glycol which are mixed with adipic acid. This polyester base is then treated with an amount of diisocyanate determined by the "reaction factor." This "R" factor, wherein lies the secret of Goodyear's development, stops the solidifying reaction of the chemicals at a point where the resultant material

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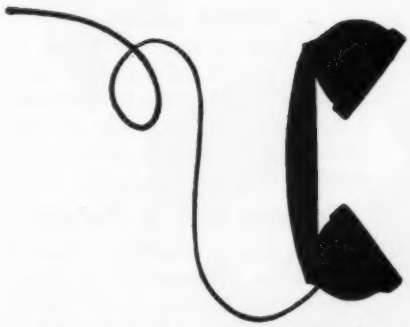

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can be further processed on mills, calenders, extruders, and other conventional equipment.

When used in the fabrication of articles, Chemigum SL is given another diisocyanate treatment and then formed into final shape without the use of sulfur or accelerators for vulcanization. Carbon black and other reinforcing agents may be added, although these are not necessary to toughen the rubber.

Mold Release

ORIGINALLY developed for the release of molded polyester and epoxy parts, CD Mold Release B has been discovered to be an excellent release agent for phenolic, melamine, and similar materials, according to Chemical Development Corp., Danvers, Mass. The firm claims that the product has proved of particular value because it is crystal clear and does not discolor jet blacks, ivory, and other colors. Molded parts have a high gloss or natural luster and require no buffing or polishing. No oily film or burned areas are left on the article.

Of equal importance is the large number of cycles obtained between applications. The exact number, of course, will depend on the part, but several molders have reported that their production has been increased considerably because the parts release quickly and the mold does not need to be lubricated as often as before.

Vinyl Plasticizer

DEVELOPMENT of a non-phthalate primary plasticizer for vinyl chloride resins, called Plastoflex MGB, has been announced by Advance Solvents & Chemical Corp., 225 Fifth Ave., New York 16, N. Y. Although it competes with plasticizers developed from phthalic anhydride, the new plasticizer is not dependent upon that material—it is a modified poly-propylene glycol dibenzoate.

Plastoflex MGB is recommended for all types of vinyl compounds, including plastisols. The product is also reportedly advantageous in compounding vinyl tile materials because it gives the finished P.V.C. compounds greater hardness. Company officials assert that test results show the following advantages over D.O.P. compositions: greater tensile strength, higher modulus of elasticity, higher boiling point, lower vapor pressure, lower volatility, and less odor.

The new plasticizer is reported to have yielded exceptional results with tin stabilizers, but to be just as acceptable with other types of stabilizers.

Adhesive

ANOTHER thermoplastic adhesive cement, called Hab-U-Co Hot-Grip, has been put on the market by Hadley Bros.-Uhl Co., 514 Calvary Ave., St. Louis 15, Mo. The producers claim that the product is effective for industrial uses where immediate setting is desirable for application to cloth, paper, leather, metal, or wood. It melts to a low viscosity and sets rapidly to give a tough, flexible bond.

Ethyl Cellulose-Vinsol

LOW-COST ethyl cellulose-vinsol resin, produced by Hercules Powder Co., Inc., Wilmington 99, Del., is now being used with wood or bark flour for compression and extrusion molding to produce unusually low-cost items. Even injection molding is deemed a possibility. It is claimed that this combination resin can be filled with wood, clay, or other conventional fillers, and hold its strength more satisfactorily than any other polymer.

Compounds can be formulated in a range costing from 10 to 17¢ a lb., depending upon the type and amount of filler used. One molder at least is using a 10% resin content in wood flour at a cost to him of around 10¢ a pound.

Normal heat distortion temperature is only 45° C., about half that of polystyrene; but when the vinsol resin is treated with hexa, the heat distortion point can be raised to 75° C.

Pulley wheels for Venetian blinds are one possibility now being tested for this material. Molded tubular forms such as curtain rollers may be developed in the near future. The material has intriguing possibilities for molders who are interested in an extremely low-cost material for applications that do not require color or high heat resistance.

Acrylonitrile Price

ACRYLONITRILE has been reduced in price from 43 to 36¢ a lb. in tank car lots by Monsanto Chemical Co. A corresponding reduction was also made in the carload and truckload drum prices to 37½¢ a pound. Less than truckload prices of drums will be 38½¢ a pound. The new prices are F.O.B. Texas City, freight equalized with Warners, N. J.

Cleaner for Acrylic Sheet

DEVELOPMENT of a non-glare, non-static acrylic cleaner has been announced by Mirror Bright Polish Co., Pasadena, Calif. The product is called Meguiar's Mirror Glaze and is intended not only for cleaning the methyl methacrylate glazing in airplanes, but also for acrylics used in automobiles, convertible tops, windows, and snap windows. It is particularly recommended for acrylic windshields on sports and racing cars.

Another use is on acrylic television screens where, the producer claims, it will prevent crazing or clouding regardless of climatic conditions.

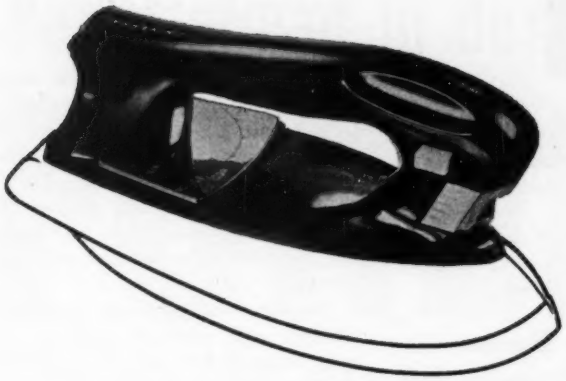
Molded Letters

FLAT back, solid acrylic letters in sizes from ⅜ to 6 in. are now offered as a stock line by Faulkner Laboratories, Tampa 1, Fla., in addition to a line of polystyrene molded letters.

Soybeans Back in Plastics

IN ITS annual statement, General Mills, Inc., Minneapolis 1, Minn., reported net earnings of $11,500,000 for the year ended May 31, 1953 as compared with $9,500,000 for the previous year; annual sales reached an all-time high of $483,000,000.

Some years ago, the company announced a diversification program, and the effect of that program is shown by noting that flour accounted for only 52% of total dollar sales in 1952, whereas in 1938 it accounted for 74 percent. Formula feeds accounted for 19%, package



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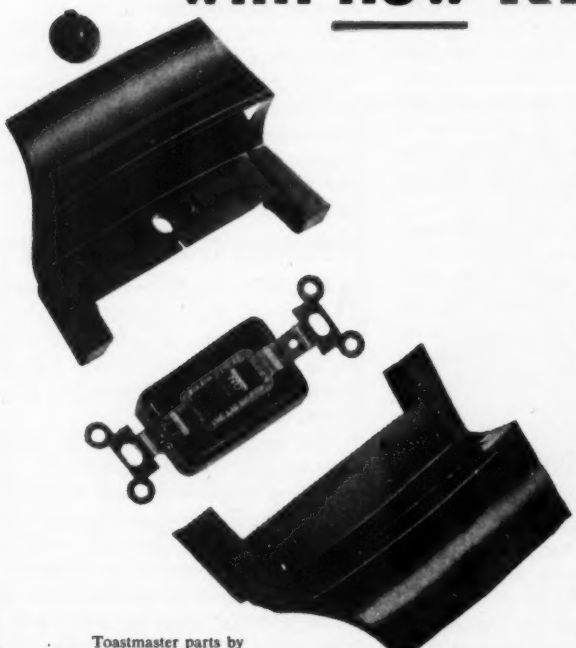

Toastmaster parts by Minneapolis Plastic Molders, Inc.; handle for Steam 'N Dry Iron by Landers, Frary & Clark; Quiette switch by Arrow-Hart & Hegemann Electric Company

First and foremost, Resinox 1004 delivers the unusual combination of free, easy flow (particularly suitable for plunger and transfer molding) *plus* fast cure, fast as any phenolic now being offered the industry. More than this, Resinox 1004 gives you:

1. Good rigidity of set, giving freedom from warpage
2. Good mold release
3. Relative low specific gravity (1.36), for more products per pound
4. Good appearance
5. Greater uniformity

Here is the ideal range of properties to build outstanding performance in superior moldings. Good reason why so many leading household appliance manufacturers are today being supplied with handles, bases and switches molded of new Resinox 1004.

In molding performance, you'll find Resinox 1004 delivers extra advantages of faster cycles, easier flow and low specific gravity that make *more profits for molders.*

So if you are not already using Resinox 1004, investigate this new material now. Mail the coupon for full information.

Resinox: Reg. U. S. Pat. Off.

MONSANTO

SERVING INDUSTRY... WHICH SERVES MANKIND

MONSANTO CHEMICAL COMPANY, Plastics Division, Room 2634, Springfield 2, Mass.

Please send me full information on new Resinox 1004 for better, more efficient molding.

Name & Title _____

Company _____

Address _____

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foods for 18%, and chemical, mechanical, and other activities for 11 percent. The mechanical activities include production of such items as food mixers, waffle grills, coffee makers, and other appliance type products. The company also produced a large quantity of equipment for the Armed Forces.

However, the news of particular interest to the plastics industry is that General Mills has apparently never given up on soybeans as a prospective raw material source for plastics and now claims to have made considerable progress in the development of a satisfactory polyamide resin from this material. By combining this polyamide with epoxy resin, there has been produced a compound which serves as a glossy finish for printed material; another is a dependable adhesive which will seal together such surfaces as wood, glass, metal, paper, plastics, and rubber; still another compound may be pigmented to form tough glossy enamels or hard compounds which can be turned on a lathe.

High Temperature Resistance

FOR several years, Narmco Resins & Coatings Co., Costa Mesa, Calif., has been testing and experimenting with a modified phenolic resin that could be used for high temperature-resistant fibrous glass fabrics and mats that would still have the handling properties and curing conditions of the existing low pressure laminating material and require no post-curing operation.

The Research and Development Div. of Narmco feels that it now has such a resin ready for market, designated as Hi-Temp Conolon 506. With this resin, laminates up to 0.375 in. in thickness may be cured at 15 p.s.i. and 350° F. in one hour. Flexural strength at 77° F. is 73,600 p.s.i. and flexural modulus is 3.45×10^6.

Tests of these laminates, without post curing indicate that, after exposure to 400° F. for ½ hr., the flexural strength is 54,200 p.s.i. and flexural modulus is 2.74×10^6.

After exposure to 500° F. for 10 hr., the flexural strength is 44,750 p.s.i. and flexural modulus is 2.51×10^6.

Tested wet after 30 days immersion in water, the flexural strength of the laminate is 60,500 p.s.i.

Polyethylene Dishware

MORE than a $100 million sales volume is expected by Tupper Corp. by the end of the next five-year period. The bulk of the Tupper volume comes from sales of their polyethylene dishware by Tupper Home Parties, Inc., Orlando, Fla. This latter company is the sales organization for Tupper dishware sold direct to the user.

The Tupper concern manufactures a line of 47 plastics kitchen items, chiefly food containers, and sells it only through its 55 franchised distributors. The distributors in turn sell the merchandise to demonstrators whom the firm calls "dealers." These dealers set up parties in homes and it is through these parties that most of the kitchen items are sold. One of the firm's distributors has chalked up a $1,350,000 sales total in one year, and several dealers have recorded as much as $2200 in sales in one week.

Incentive plans help to keep dealers and distributors on their toes. Last year Tupper gave away seven Cadillac cars to distributors with top sales figures. This year, mink coats, an airplane, a car, and a speedboat will be presented to the large volume-creating distributors.

Protection Against Sun

TWO new thermoplastic products which are claimed to give protection against the sun's heat, glare, and ultra-violet rays are about to be marketed by Eastern Industrial Service, Inc., 17 Day St., Cambridge, Mass. Designated as Thermoglare film, a sprayed-on plastics coating, and Thermoglare sheet, a solid plastics sheet, the products are reported to have cut air conditioning, fuel, and electricity costs in the plants where they have been used. Tests have shown that the new thermoplastics will filter out up to 95% of ultra-violet light and eliminate approximately 80% of infra-red radiation.

Thermoglare film is applied with a spray gun. The sheet is available in different gages, the thickness of which depends upon the size of the window area. It is shatterproof and is designed to be used instead of glass window panes. Both materials can be used in either hot or cold climates.

The film sells for approximately $14 per gal., which is sufficient to coat between 300 and 350 sq. ft. of surface. The sheet sells for about 70¢ per sq. ft. for the 0.060 gage and around 88¢ per sq. ft. for the 0.080 gage.

Coating for Styrene

DEVELOPMENT of a scratch- and flame-resistant transparent coating for polystyrene which makes the surface of the plastic immune to most common solvents has been announced by Schwartz Chemical Co., Inc., 326 W. 70th St., New York, N. Y. Designated as BE-40, its outstanding features are high gloss, extremely high adhesion, and resistance to physical abuse.

According to the manufacturer, the coating is completely unaffected by all common tests for adhesion, including the finger nail and Scotch tape tests. The clear, transparent coating will not affect the clarity of the polystyrene surface to which it is applied.

Polyvinyl Chloride Sheeting

ANNOUNCEMENT of the availability of Vyflex rigid polyvinyl chloride sheeting from 0.012 to 0.025 in. is announced by Kaykor Industries, Inc., Div. of Kaye-Tex Mfg. Corp., Yardville, N.J.

The company states that in addition to all standard methods of fabrication for thermoplastic materials, Vyflex rigid polyvinyl chloride can be fabricated by hot-gas welding which makes possible the construction of complex structures such as fume exhaust systems, acid tanks, and other equipment or parts exposed to severe corrosive conditions.

Dry Blend Vinyl

HEAT-STABLE vinyl compounds for injection molding that are adaptable to easy dry blending have been introduced by Monsanto Chemical Co.'s Plastics Div., Spring-

Years ahead in design and performance!

FOREMOST

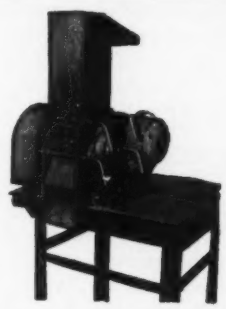
Beside-the-press PLASTIC SCRAP GRINDERS

Three field-tested models for 2 oz. to 200 oz. injection presses
...guaranteed to grind vinyl and polyethylene *without fluffing!*

Foremost Plastic Scrap Grinders are outstanding in every way. They employ a unique double-shear knife arrangement which permits grinding of injection molding scrap into neat granules...without fluffing. They are highly economical to maintain and low in initial unit cost. To see how a Foremost unit will work in your plant, see offer below.

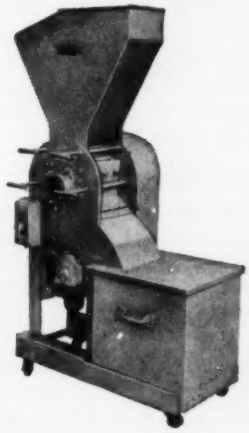
10 specific design features of FOREMOST

- no fly-back of material from hopper, no leakage anywhere.
- quickest and easiest to clean, low in maintenance cost.
- no wrenches required to remove hopper or screen.
- no jamming when fed hot sprues with hardened material.
- Special arrangement for feeding extra long sprues.
- convenient material bin supplied with cutter.
- unique double shear knives cut soft plastics easily.
- all steel construction.
- no exposed moving parts.
- batch grinds without any overheating.



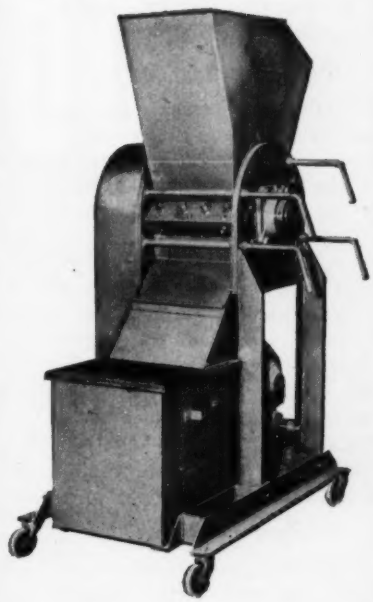
MODEL 1A (½ HP)

Bench model recommended for laboratory use, or beside small injection presses. Available with or without material bin. Single phase, 110/220 volts. THROAT SIZE 3½" x 5".



MODEL 2A (1½ HP)

Floor model with casters. 250 units now in service throughout the U.S. Capacity ¼" screen — polystyrene material —150 lbs. per hour. THROAT SIZE 4" x 8".



MODEL 3C (3 HP)

Floor model with casters. Excellent for heavy sprues or parts such as brush-backs. Recommended for beside large presses; can be used for batch grinding up to 300 lbs. per hour. THROAT SIZE 6" x 12".

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field, Mass. David S. Plumb, divisional sales manager for vinyl resins and compounds, states that dry blending with Monsanto's Opalon 300 vinyl resin offers injection molders a 25% saving on material costs and a vinyl material with high heat stability.

Dry blended vinyl compounds are especially recommended for injection molders who do not have expensive mixing and milling equipment and, according to Mr. Plumb, because dry blending takes place at relatively low temperatures, compounds reach the injection machine with a minimum of heat history and, therefore, tendency toward decomposition is reduced sharply.

The new blends contain plasticizer, filler, stabilizer, and lubricant. They are supplied in natural, black, or white and may be drum-tumbled with dry pigment to produce an unlimited range of colors.

Polyester Awnings

REINFORCED plastics awnings have been approved for commercial installation by St. Louis Building Commissioner Albert H. Baum, according to Monsanto Chemical Co., St. Louis, Mo.

The company arranged a demonstration to determine the flammability of polyester glass awnings. A blow torch was used to produce the extremely high temperatures needed to ignite the test panels and flame travel, smoke, odor, flame stoppage, and extinguishment with air and water were observed and evaluated.

Spray Masks

PRECISION spray masks especially designed with plastics molding and painting problems in mind are now being marketed by Rabsco Plastic Specialties, Inc., 906 E. 132nd St., Hawthorne, Calif.

Bernard W. Montag, Jr., secretary and treasurer of the company, states that precision masks are used in decorating plastics nameplates, knobs, trays, door, and other specialty plastics parts in the appliance and allied fields. These have become necessary parts for automobiles, refrigerators, deep freeze units, radios, and television sets. Accurate masking is therefore a necessary part of the manufacturing operations.

Styrene Copolymer

TWO new high-impact styrene copolymer resins for molding and extruding have been developed by The Goodyear Tire & Rubber Co., Akron, Ohio. The new resins will be marketed under the name of Plio-Tuf. Company officials claim that Plio-Tuf resins give 8 to 10 times the impact strength of the highest impact polystyrene resins.

Plio-Tuf G85C has a heat softening point of approximately 90° C. with a Shore D hardness of 85. Plio-Tuf G75C has the same softening point but a lower hardness of 75. Both resins are available as a white powder which can be pigmented.

The compounds do not require curing ingredients, accelerators, plasticizers, or modifiers. However, if desired, the resins can be plasticized with GR-S or Neoprene rubbers to obtain even higher impact strengths in addition to fire retardant properties. The compounds can also be calendered or extruded into sheets for post-forming into complex shapes or can be extruded into rods or tubes.

Repair Kit

A REPAIR kit containing all the necessary material for mending vinyl products of all kinds is being marketed by U. S. Fiber and Plastics Corp., 200 Fifth Ave., New York, N. Y.

The kit includes an adhesive waterproof cement and assorted patches of vinyl that can be used to mend play or household items ranging from shower curtains, tablecloths, draperies, and auto seat covers to inflatables and other vinyl film or sheet products.

Fluorocarbon Packing

DEVELOPMENT of a packing material that is self-sealing and self-adjusting at finger-tip gland pressures has been announced by W. S. Shamban & Co., 11617 W. Jefferson Blvd., Culver City, Calif. The material is molded Kelon-T which is produced from Teflon.

Upon application of hydraulic pressures, the seal expands even with very low pressure against the stuffing box and inward against the stem for tight sealing with minimum friction. Natural slipperiness of the material insures that the seal will not "freeze" even if not used for long periods of time.

Resin for Granulated Wood

AVAILABILITY of a new phenolic resin combining high flow and fast cure and especially designed as a binder for granulated wood has been announced by Monsanto Chemical Co.'s Plastics Div., Springfield, Mass.

The product is called Resinox 743. During the past several months, it has been used successfully in the mass production of furniture, toys, and housewares made from sawdust and other wood wastes.

Auto Windows

ANOTHER new use for plastics by the automotive industry is in windows on the special Chevrolet Corvette sports car. These windows, made of Plexiglas acrylic, snap in place in a special molding along the tops of the doors and can be used with the folding top either up or down. When not in use, the acrylic windows are stored in the luggage compartment.

The Corvette, it will be remembered, was the first sports car with a reinforced plastics body to be placed in production by a large motor car manufacturer.

Aisle Markers

SOMETHING new in aisle markers for use in industrial plants, offices, warehouses, parking areas, airport runways, and other places where aisle marking is essential has been announced by W. H. Brady Co., 727 W. Glendale Ave., Milwaukee 12, Wis.

Aisle markers are produced from vinyl film backed with a heavy-duty pressure sensitive adhesive and stocked in four colors—yellow, red, green, and white—that command attention even in poorly lighted areas.

Besides costing far less to buy than paint, molded markers, or tape, these vinyl swatches can be easily

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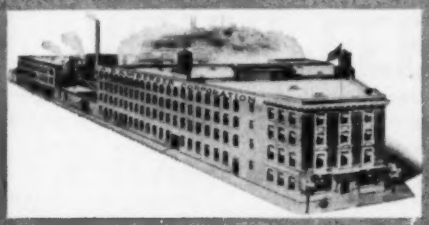

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and economically applied. Further, there is no production time lost waiting for paint to dry and no clean-up work is necessary. The company claims that these markers are highly resistant to abrasion, and last five times longer than painted lines.

Stock markers are available in circular swatches and directional arrows. Special sizes, colors, and shapes are made up to order.

Plastics in Missiles

GREAT BRITAIN has developed 2000-mile-per-hr. missiles as the latest in her advances in the development of guided rockets, according to Duncan Sandys, Britain's Minister of Supply. Mr. Sandys pointed out that in the effort to reduce weight and thus to lessen strains on the rocket, Britain's scientists are turning experimentally from metals to plastics and that before very long it may be possible to make the whole of the rocket's casing out of these light materials.

Renovating Wood

FURANE plastic is now finding use as a renovating material for wood and Masonite table tops and equipment, according to Furane Plastics, Inc., 4516 Brazil St., Los Angeles 39, Calif. The material, called Jet-Kote, is a dark-colored resin which will chemically set at room temperature, yet possess good heat and chemical resistance.

Industrial Materials

THREE new items—Ace-Flex, Ace-Riviclor, and Dur-Ace—for chemical, electrical, and mechanical applications have been added to the line of products produced by American Hard Rubber Co., 93 Worth St., New York 13, N.Y.

Ace-Flex is a plasticized polyvinyl chloride material with good electrical properties and outstanding chemical resistance. Furnished in flexible tubing and sheet form, it is recommended for bottle-filling machinery, hospital equipment, battery separators, and similar applications.

Ace-Riviclor is a rigid vinyl now being used in the chemical field, particularly for pipe fittings, tank linings, formed and molded pump and valve parts, and similar products.

Dur-Ace is a styrene multi-polymer material with high impact strength and excellent dimensional stability. This material is recommended for formed and draw-molded parts, as well as for corrosion-resistant pipe.

Silicone for Leather

AN IMPROVED silicone water repellent for leather produced by Dow Corning Corp., Midland, Mich., is now on the market. Designated as Dow Corning 1109, the new material imparts a high degree of water repellency without appreciably altering the appearance, feel, or breathing characteristics of the leather. Treated leather remains water repellent even after prolonged aging or wear.

School for Welding

THE opening of a plastics welding training school has been announced by American Agile Corp., P.O. Box 168, Bedford, Ohio. All those who are interested in the study of structural fabrication of thermoplastic materials, as well as those who wish to learn how these procedures can be used to provide protection against the ravages of corrosion in their particular industry, can now avail themselves of this opportunity.

The welding courses consist of lectures, design, theory, welding exercises, advance course and design of welding construction, reinforcements, and structural design as influenced by temperature and chemical resistance.

Complete details and an explanatory booklet may be obtained from the company upon request.

Vinyl Acetate Copolymer

AN INTERNALLY plasticized vinyl acetate copolymer, which is claimed to eliminate problems inherent in the compounding of polyvinyl acetate with chemical plasticizers, is now being offered by the Organic Chemicals Div. of Dewey and Almy Chemical Co., 62 Whittemore Ave., Cambridge 40, Mass. Called Darex Everflex, the new copolymer has permanent plasticity and thus eliminates the need for additional plasticizers.

The company has also announced that John G. Broughton, Jr. will head midwest sales for its Organic Chemicals Div. plant in Chicago, Ill.

Low-Temperature Tubing

A NEW clear plastic tubing developed to meet the rigid technical requirements of the Armed Services is now offered to industry by Irvington Varnish and Insulator Co.'s Fibron Div., Irvington 11, N.J. Designated as Airflex 6904, the tubing is approved under the new specification MIL-I-7444A (USAF) and provides high flexibility at extremely low temperatures, coupled with fungus resistance.

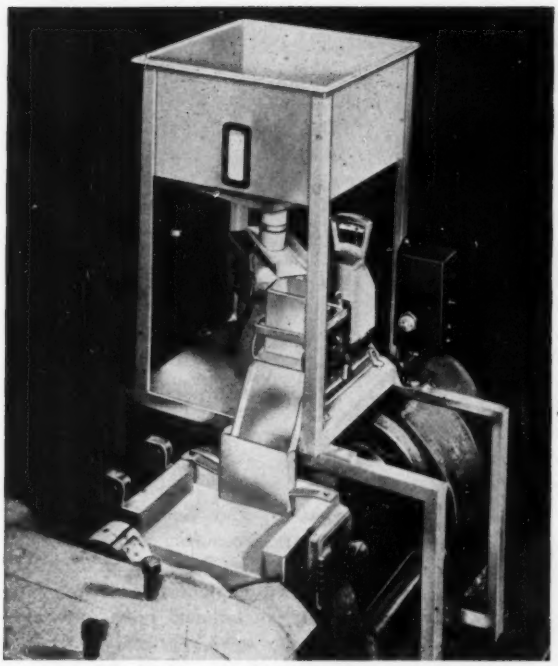
The tubing is widely applied as both primary and secondary insulation. Airflex 6904 is used as wire harness sheathing where low temperature flexing is a problem, as a wiring conduit where its good abrasion resistance is needed, and as a fluid drain or transfer medium.

EXPANSION

American Cyanamid Co.'s Calco Chemical Div., Bound Brook, N. J., will construct a $14 million plant on a 1600-acre tract of land on the outskirts of Savannah, Ga., for the production of titanium dioxide. Completion of the plant is expected in early 1955. This will be Calco's third facility for the production of titanium dioxide, which is marketed by American Cyanamid under the trade name of Unitane. The other two plants are located at Piney River, Va., and Gloucester City, N. J.

Decar Plastic Corp., Middletown, Wis., developers of the recently announced Decartone process, has purchased the inventory and equipment of **Plastics Specialties Co., Inc.**, Trenton, Mich., specialists in the production of resin impregnated materials under the trade name of Lamiply. Under the present arrangement, Decar will continue the production and sale of Lamiply, as well as the Decarlite decorative and industrial laminate grades.

Decar is under the management



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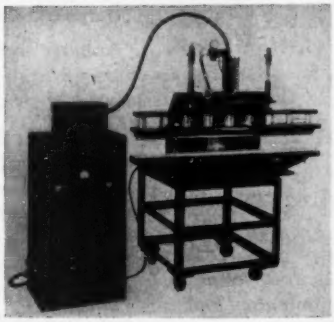
MAYFLOWER 2-POSTER

Here's a press for high speed production on those long straight seals for raincoat facings, curtain headings and plastic inflatables. Powered by the 2½kw Mayflower generator, it has a giant spread of 60" and may even be had up to 84". Early delivery assured.



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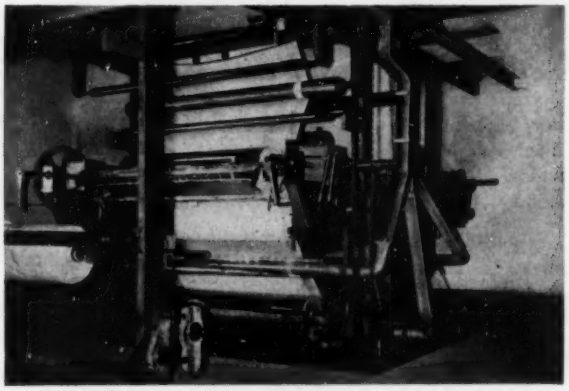
- **no exposed gearing**
- **Repeats in patterns from 14" to 72" and larger upon request**



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of **George Johnson**, plant manager, with **T. Walter Noble**, formerly general manager of Plastics Specialties, as technical director.

Monsanto Chemical Co. has announced plans to increase production capacity at Springfield, Mass., for tough, high-impact styrene by 30 million lb. a year. The new facilities are expected to be ready for operation in eight months. **R. C. Evans**, general sales manager of the company's Plastics Div., predicts that within the next five years the bulk of all styrene applications will be manufactured in tougher, more durable material.

Columbus Plastic Products, Inc., producer of Lustro-Ware plastics housewares, has recently completed a major addition to its plant and facilities at 1625 W. Mound St., Columbus, Ohio. This expansion, the fourth in six years, is a three-story section which provides 50,000 sq. ft. of floor space, bringing the total plant area to over 200,000 sq. ft. The plant covers about five acres and includes offices, engineering and designing departments, a die shop, and molding and finishing departments. The present production equipment includes 42 injection molding machines. The Lustro-Ware line now numbers over 125 plastics housewares items.

Paradise Mfg. Co., manufacturer of plastics shower curtains and table covers, has added 10,000 sq. ft. of floor space to its factory at 4159 E. Olympic St., Los Angeles, Calif. The new acquisition will house the electronics department of the company and also the Al Mac Rainwear subsidiary of Paradise.

O'Sullivan Rubber Corp., Winchester, Va., has broken ground for a new manufacturing building. **V. A. Catozella**, president, states that the move represents the first step in a major expansion and improvement program which will incur an expenditure of $900,000 in the next three years. It is estimated that the over-all plan will step up the annual production capacity to a range of $12 to $15 million from the present level of $9 to $10 million. The increase will be approximately two-thirds in the rubber division and one-third in the plastics division.

Reichhold Chemicals, Inc. has acquired space for its executive departments in the new Alexander Smith, Inc. building, 525 N. Broadway, White Plains, N. Y. The company will also move the financial and technical units from its Detroit plant to the new location. Reichhold will continue to maintain its office at 630 Fifth Ave., as a New York sales office.

Barrett Div., Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y., announces that its new $5 million phthalic anhydride plant at Calumet (Chicago), Ill., is now in full operation. **T. J. Kinsella**, president, states that the capacity of the new plant, plus that of a similar installation in Philadelphia soon to be completed, will eliminate the possibility of a short supply of phthalic anhydride for some years to come. Barrett is also a major producer of naphthalene, the basic raw material from which phthalic anhydride is produced.

COMPANY NOTES

Continental Can Co., Inc., 100 E. 42nd St., New York 17, N. Y., has set up production of its decorative and industrial laminate, Conolite, at the company's crown and cork plant in Milwaukee, Wis. The Conolite operation is expected to produce a sales volume of $1,500,000 during its first year. The main Conolite sales office, headed by **A. P. Vining**, general manager of sales (crown and cork), is located in Wilmington, Del.

Celluplastic Corp., 50 Avenue L, Newark 5, N. J., announces the appointment of **Augustus T. DeVera, Jr.** to its sales staff.

Farrel-Birmingham Co., Inc., Ansonia, Conn., announces that **Gerald R. Gonyer** has been appointed manager of its Chicago office, 120 S. LaSalle St., succeeding Harry D. Temporal who has retired after 43 years with the company. Mr. Gonyer joined the organization in 1937. **Franklin R. Hoadley, Jr.**, sales engineer, has been transferred from the main office at Ansonia to the branch office at Akron, Ohio.

The Hydraulic Press Mfg. Co., Mt. Gilead, Ohio, has organized a manufacturing center in the Netherlands, **Hydraulische Pers Maatschappij Nederland, N. V.** As a wholly-owned subsidiary, it will produce a full line of presses for distribution in western Europe and other territories and will coordinate sales, service, and manufacturing facilities, with headquarters at 558 Keizersgracht, Amsterdam, Holland. Officers of the new corporation are: **G. B. Robinson**, chairman of the board; **John C. Cotner**, president; **John M. Dolan**, vice president; and **George A. Daniels**, secretary-treasurer. **W. M. Truska, Jr.**, who has been in Hydraulic's sales and engineering departments at Mt. Gilead, has been appointed European sales representative.

Borden Co.'s Chemical Div., 350 Madison Ave., New York 17, N. Y., has appointed **John W. Maxwell** and **Eric Mackey** as technical service specialists for its Industrial Adhesives Department. Mr. Maxwell, who has been an assistant in Borden's Bainbridge, N. Y., wood adhesives laboratory, will handle technical service in the woodworking field; Mr. Mackey, formerly with the plastics division of Ciba Co., will handle technical service on formaldehyde, hexamethylenetetramine, and epoxy resins.

Auburn Button Works, Inc., announces that its Chicago office is now located at 4650 W. Lawrence Ave.

Industrial Plastic Co., manufacturers of Tuff-Lite garden hose, is now in full operation at its new quarters, Tingley Lane, P. O. Box 1188, Plainfield, N. J. The new site, providing 20,000 sq. ft. of space on 10 acres of property, comprises four fully equipped buildings, including offices. The company reports that facilities are now available for milling, compounding, straining, coloring, pelletizing, and extruding vinyl and polyethylene.

Erie Resistor Corp., Erie, Pa., has named **Allen K. Shenk** and **Jerome D. Heibel** as vice presidents in charge of sales and research and engineering, respectively. Mr. Shenk joined the organization in 1942 as assistant sales manager of the electronics

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Big plasticizer bills are no problem when you use *S/V Sovaloid C*. It's the most economical plasticizer available for vinyl resins and nitrile rubbers—can save you from 30% to 90% when used to extend more expensive ester-type plasticizers. And it offers you all these other processing advantages:

S/V Sovaloid C *won't migrate* from your finished products . . . is completely compatible with all vinyl and nitrile rubber compounds and well suited to plastisol formulations. It gives good flexibility, excellent oil resistance and high tensile strength.

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division; Mr. Heibel, 17 years with Erie, has been director of research and engineering since 1949.

American Reinforced Plastics Co., 650 S. Spring St., Los Angeles 14, Calif., is the new name of the firm formerly known as **Warnken Engineering & Mfg. Co.**

Michigan Chrome & Chemical Co. has moved to 8615 Grinnell Ave., Detroit 13, Mich. The office, built in conjunction with the company's new plant, brings management, sales (both Chemical and Plating Divs.), accounting, and purchasing under one roof.

Emery Industries Inc., Carew Tower, Cincinnati 2, Ohio, announces the appointment of the following district sales managers for its Chemical Sales Div.: **James W. Ritz,** formerly head of the Philadelphia office, is now eastern district manager; **Harry D. Armitage** will continue as district manager at large, with headquarters in the Woolworth Bldg., New York, N. Y.; **Willard A. Colby** becomes southern district manager with offices in Charlotte, N. C.

Thermomat Co., Inc., Trenton, N. J., manufacturers of radiant heating panels for the plastics industry, has appointed **Wyrough & Loser,** 143 E. State St., Trenton, N. J., as manufacturer's representatives.

Rohm & Haas Co., Washington Sq., Philadelphia 5, Pa., has elected **John C. Haas** a vice president and member of the executive committee. Mr. Haas has been a director of the company since 1948.

Cincinnati Development and Manufacturing Co. has moved to 5614 Wooster Pike, Cincinnati 27, Ohio.

Grace Chemical Co., 60 Beaver St., New York 4, N. Y., has named **Vincent L. Rebak** as New York district sales manager and **C. J. Bown** as district manager in Memphis, Tenn. Mr. Rebak's former affiliations were with Dodge and Olcott as assistant to the vice president in charge of sales, and Heyden Chemical Corp., where he was the company's representative in the New York Paint, Varnish, and Lacquer Assn. Mr. Bown's previous connections were with Celanese Corp. of America and Union Carbide & Carbon Corp.

Associated Plastic Companies, Inc., has moved its executive offices from Chicago to 400 E. Hines St., Midland, Mich., where the plant is located.

The Lanly Co., 754 Prospect Ave., Cleveland 15, Ohio, has appointed **Omni Products Corp.,** 460 Fourth Ave., New York, N. Y., as exclusive export sales representatives for its line of plastics preform ovens.

Adams Plastics Co., Inc., Holyoke, Mass., announces the retirement of its president, **Will Adams. Samuel Resnic,** treasurer, has acquired the interest of Mr. Adams and succeeds him as president. **George P. Alderman,** vice president and general manager, and **Burton S. Resnic** have been elected directors of the company. A new laminating division has been recently formed for the production of basic raw materials for Pakkawood, formerly purchased from other sources. The new division, directed by **L. F. Hanson,** formerly of Bakelite Co., will enable the company to expand to other fields.

Federal Supply Corp., 47 Godwin St., Paterson, N. J., has organized the Corrosion Resistance Div. to service the plastics industry. The company also has maintenance warehouses in Paterson to meet the plastics needs of the textile industry.

A. Schulman, Inc., 790 E. Talmadge Ave., Akron, Ohio, is this year celebrating its 25th anniversary in business. Established primarily to serve the reclaim rubber plants, the company has broadened out as importer and dealer in crude rubber and in reclaimed and reprocessed plastics materials. Schulman now has two main plants located on more than 40 acres of land.

Reynolds Metals Co., Richmond, Va., has made the following appointments in its Plastics Div.: **Frank W. MacClean** has been named general manager of the division in Gary, Ind.; **Woodrow J. Vogel,** western regional sales manager in Los Angeles, Calif.; **Albert P. Brizzie,** central regional sales manager in Chicago, Ill.; **Richard W. Little,** eastern regional sales manager in New York, N. Y.

Heyden Chemical Corp., 342 Madison Ave., New York 17, N. Y., has appointed **Arthur W. Willis,** former assistant plant manager of the company's plant at Princeton, N. J., as plant manager at Fords, N. J. Mr. Willis succeeds E. R. Herrick who has retired after 30 years with the company. Mr. Herrick will continue as consultant for Heyden.

Koppers Co., Inc., Chemical Div., Pittsburgh 19, Pa., has established a new sales office located in the Healey Bldg., Atlanta 3, Ga., headed by Leo J. Diamond.

The Goodyear Tire & Rubber Co., Akron 16, Ohio, has organized a new chemical division sales office in Portland, Ore. **Roy Williams,** in charge of the office, will cover the Pacific Northwest territory.

Vernon-Benshoff Co., 933 Ridge Ave., Pittsburgh 12, Pa., announces the election of the following officers and managers: **Lester B. Vernon,** chairman of the board; **John F. McGowan,** president and treasurer; **Harold M. Vernon,** senior vice president in charge of research and development; **Edwin R. Freas,** vice president and general manager; and **Ida M. Harman,** manager of Plastics Arts Div.

Du Pont Co. announces the retirement of **Leslie B. Gillie,** who has been assistant director of sales for the Polychemicals Dept. Mr. Gillie joined the company in 1915 as a chemist and was later transferred to the plastics development department at the Arlington, N. J., plant in 1919, where he was general supervisor for the manufacture of cellulose nitrate plastics. Later, he participated in the development of markets for Lucite acrylics. In 1946, he became director of the plastics department, and when that department was combined with the ammonia department, he was appointed assistant director of sales for the resultant Polychemicals Dept.

Clarence D. Bell succeeds Mr. Gillie. Mr. Bell joined Du Pont in 1937 and has been technical supervisor in the Morgantown, W. Va., Ordnance Works and in 1950 was named general laboratory director of the Polychemicals Dept. Mr. Bell was appointed marketing analysis manager

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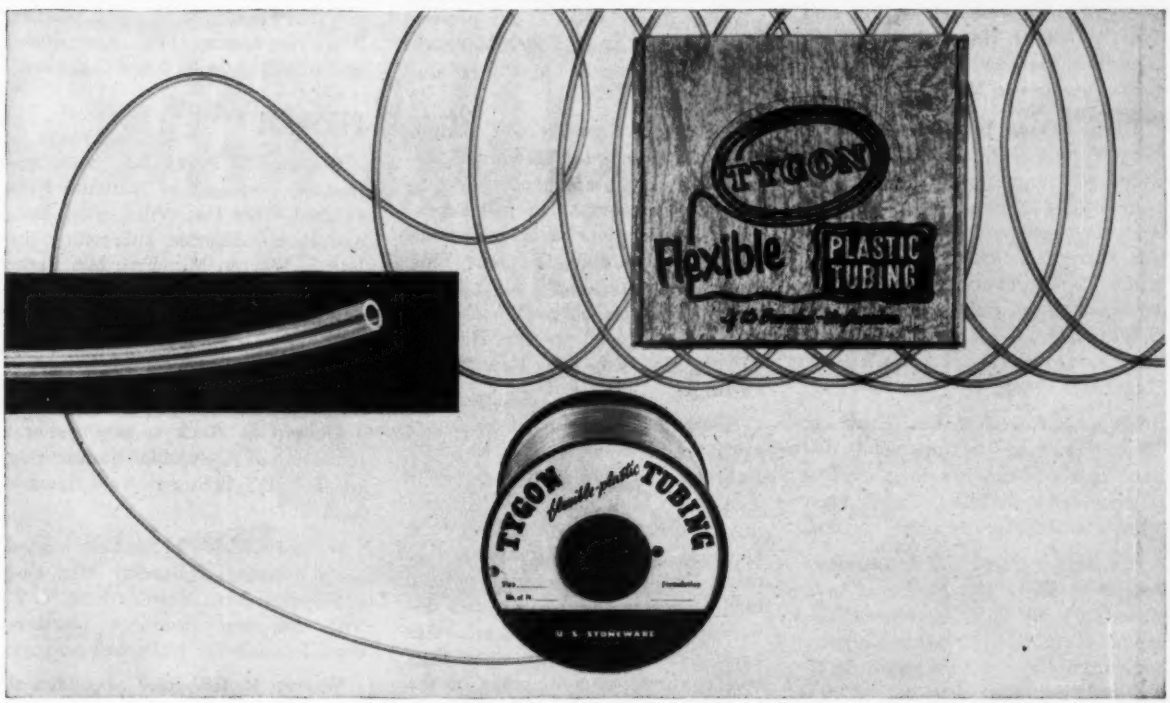
This manufacturer selected DOW PVC for its cleanliness and low lead content to produce non-toxic, pyrogen-free, sterilizable tubing



To produce this 2,000-ft. reel of intravenous tubing and packet of blood transfusion tubing, the manufacturer took advantage of outstanding characteristics of Dow PVC 100.

Dow PVC 100 offered exceptional cleanliness and low lead content—extremely important properties in producing pharmaceutical tubing which must be non-toxic, pyrogen-free and suitable for sterilization at 15-lbs. steam pressure.

The special advantages of Dow's PVC packaging entered into consideration, too. The resin was supplied packaged to assure freedom from contamination so that the manufacturer received the highest quality raw material for his exacting requirements. Dow PVC shipping containers include 50-lb. multi-wall paper bags or standard 41-gal. saran-lined fiberpaks.

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in 1952, later becoming an assistant director of sales. **William A. Franta,** formerly general laboratory director of the research division of Polychemicals, has been made manager of the development and service section of the sales division in that department; **Edward B. Cooper,** former manager of the plastics application research section, succeeds Mr. Franta as general laboratory director; **Francis B. Vaughan** steps in as head of the application research section; and **Dr. Clement H. Hamblet,** senior research supervisor, has been promoted to succeed Mr. Vaughan.

Glass Fibers, Inc., 1810 Madison Ave., Toledo 2, Ohio, announces that **John A. Morgan,** who has recently completed a three-year tour of duty as a lieutenant colonel in the U. S. Air Force, has joined its sales staff and will be in charge of sales to the transportation field. **Stewart W. Schulmeyer** has been appointed manager of electrical sales for the Textile Division.

Metasap Chemical Co., Harrison, N. J., has prepared a new chart describing the company's complete line of stearates and their properties and uses, available gratis upon request.

Celanese Corp. of America's Chemical Div., 180 Madison Ave., New York 16, N. Y., announces the transfer of its Application Laboratory from Newark to Summit, N. J. **Edward Swanezy** has joined the division as a sales representative and will handle the metropolitan New York area; **Harry Bartley** has been transferred from the New York office to represent the mid-Atlantic district. **Robert J. Davis** and **Sidney B. Smith** have joined the product development department. Mr. Davis will handle sales development of vinyl acetate and Mr. Smith will engage in market research work.

The Plastics Div. of the company in Los Angeles, Calif., has moved to larger quarters at 3460 Wilshire Blvd., with **R. J. Hough** as Pacific Coast district sales manager.

Monsanto Chemical Co.'s Plastics Div., Springfield, Mass., announces the promotions of **James F. McKeon** and **Warren J. Clark** as sales representatives for industrial resins in Cincinnati, Ohio, and St. Louis, Mo., respectively.

The General Tire & Rubber Co., Akron, Ohio, has named **Robert Hamilton** sales representative to handle Fashon vinyl film and sheeting in Illinois, Iowa, Minnesota, Missouri, and Wisconsin. Mr. Hamilton replaces **Walter Reilly,** who has been assigned to the company's plastics plant at Jeannette, Pa., for product development work. Mr. Hamilton was formerly associated with Goodall Fabrics, Inc.

The Black-Clawson Co., Fulton, N. Y., has appointed **Howard P. Espenmiller** as director of the company's laboratories. He will supervise the operations of all laboratory facilities, including the new Dilts converting laboratory. Mr. Espenmiller succeeds George B. Nicholson, who has resigned to join National Folding Box Co., Inc., New Haven, Conn.

Hooker Electrochemical Co., Niagara Falls, N. Y., announces that **J. H. Babcock,** formerly vice president in charge of development and research, has been named vice president of the company and **Dr. J. H. Bruun,** formerly director of research, has been made director of research and development. Mr. Babcock, who has been with the company since 1916, will continue as a member of the research committee and will also remain in charge of the general developments division. Dr. Bruun was formerly affiliated with General Aniline and Film Corp., Sun Oil Co., and National Bureau of Standards.

Pullman-Standard Co., 79 E. Adams St., Chicago, Ill., parent company of **The M. W. Kellogg Co.,** has announced that a permanent display of Kel-F polymer materials, showing more than 125 different applications, has been set up in the company's industrial showroom. The exhibit will be open to the public at all times.

The Dow Chemical Co.'s sales reached a new high, totaling $430,400,000 for the fiscal year ended last May 31. In 1952, the sales were approximately $407 million. Earnings after taxes in fiscal 1953 totaled $35,857,000; earnings before taxes on income were $109,500,000 in 1952 as compared with $86,600,000 in 1953. However, the company allowed $52 million in 1953 for depreciation, amortization, and depletion of plants and equipment as compared with $33 million in 1952. Dow spent approximately $94 million on construction during the last fiscal year and expects to spend approximately $75 million on new construction in 1954.

Magnesium sales rose from $45 million in 1952 to $60 million in 1953 and plastics sales increased to $130 million. Industrial chemicals accounted for 48% of all sales; plastics, 30%; magnesium, 14%; agricultural and fine chemicals, 6 and 2 per cent.

PERSONAL

Eugene R. Perry has been appointed president of **National Vulcanized Fibre Co.,** Wilmington, Del., and its subsidiaries, succeeding the late J. Warren Marshall. Mr. Perry will also continue to hold the offices of director and general manager of the company. He was formerly manager of the Micarta Div. of Westinghouse Electric Corp., Trafford, Pa.

George H. Beck is now general manager of **Columbia Engineering Co.,** Inc., 113-19 Sussex Ave., Newark 3, N. J.

Harold J. Kolenski has been named sales director of **Barclay Mfg. Co.,** 385 Gerard Ave., New York 51, N. Y. The company produces plastics-coated panels for walls and ceilings.

Warren E. Hill, vice president of **Emhart Mfg. Co.,** has been elected executive vice president of **Plax Corp.,** Hartford 1, Conn., a subsidiary of Emhart.

James W. Kearns, Jr. has been appointed to the sales staff of **Bigelow-Sanford's Fiber Glass Products Div.,** 140 Madison Ave., New York 16, N. Y. Mr. Kearns was formerly eastern sales manager for the plastics division of Continental Can Co., Inc.

Robert W. Dunmire, formerly in charge of development operations at the canopy and laminates division of **Goodyear Aircraft Corp.,** Akron, Ohio, a subsidiary of Goodyear Tire & Rubber Co., has been named acting division manager. Mr. Duhmire succeeds Robert S. Ames at Goodyear

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Aircraft, who has been granted an A. P. Sloan Fellowship for a one-year course at Massachusetts Institute of Technology.

Eldon B. Hunt is now regional sales manager of the plastics division of **Jackson and Church Co.**, Saginaw, Mich. He will represent the company's complete line of presses in Illinois, Indiana, and Michigan, with headquarters at Owosso, Mich.

Charles P. Egolf III has been named sales and service representative for **Diamond Alkali Co.**, 300 Union Commerce Building, Cleveland 14, Ohio, to handle the company's complete line of products in Florida.

Bernard Alexander has been appointed sales manager of **Sterling, Inc.**, 3738 N. Holton St., Milwaukee, Wis.

Philip M. Andress has been named sales representative for the Boltaron and custom injection molding divisions of **The Bolta Co.**, Lawrence, Mass., to cover eastern Pennsylvania, southern New Jersey, Maryland, Delaware, Washington, D. C., and Fairfax County, Va.

Ralph B. Waldron has joined **Michigan Molded Plastics, Inc.**, Dexter, Mich., as manufacturing and product engineer. Mr. Waldron was formerly associated with General Electric Co., Sylvania, and General Industries.

John B. Kohler, formerly president of The Kohler System Co., has opened a consultant office at 218 Woodstock St., Crystal Lake, Ill., where his services will be available for consultation on winding and rewinding equipment used in the paper and plastics industries.

L. D. Harvey, formerly with the plastics sales department of The Dow Chemical Co. for six years, has become sales manager of **Nichols Industries,** Pasadena, Texas, manufacturers of toy pistols and other plastics toys.

Milton Brucker, president of **Zenith Plastics Co.**, Gardena, Calif., on a tour to Europe, attended the Fourth International Aeronautical Conference of the Royal Aeronautical Society and the Institute of Aeronautical Sciences in London, England, with his chief engineer, William E. Braham. During his visit, Mr. Brucker conferred with many of the leaders of the aircraft and plastics industries.

Dan Lewis, Jr., special field sales representative for **The Goodyear Tire & Rubber Co.'s Chemical Div.**, has been transferred from Dallas, Texas, to Houston.

Sumner E. Tinkham has resigned as executive engineer from Shaw Insulator Co., Irvington 11, N. J.

Stewart Hoagland is now manager of advertising and promotion of **Interchemical Corp.**, 67 W. 44th St., New York 36, N. Y. Mr. Hoagland has been associated with the organization in an advertising and editorial capacity since 1938, when he became editor of *R-B-H Dispersions*, a divisional publication.

Jerold L. Welch is now chief engineer of **Reed-Prentice Corp.**, Worcester 4, Mass.

Dwight L. Allen has been named manager of **American Anode** sales for **The B. F. Goodrich Co.'s Industrial Products Div.**, Akron, Ohio. Mr. Allen joined the company in 1936.

Ed Keusch has been appointed sales engineer of **The Fiberite Corp.**, Winona, Minn., and will represent the company in Long Island, N. Y., Newark, N. J., Philadelphia, Pa., and Washington, D. C.

Dean M. Cochran has been named assistant sales manager of **The Hydraulic Press Mfg. Co.**, Mt. Gilead, Ohio, and manager of the company's Metalworking and Process Press Sales Division.

Irving Ash has joined **The Baker Castor Oil Co.**, 120 Broadway, New York, N. Y., and will be in charge of sales development.

James C. White, president and general manager of **Tennessee Eastman Co.** and president of **Texas Eastman Co.**, has been elected director of **Eastman Kodak Co.**, Rochester, N. Y. Mr. White is widely known for his leadership in helping to develop Tennessee Eastman Co.'s position in the chemical, textile, and plastics fields. He has been associated with Tennessee Eastman for 33 years.

K. K. Boyd, formerly director of sales and purchases, has been elected to the newly created post of vice president in charge of sales and purchases of **Emery Industries, Inc.**, Carew Tower, Cincinnati 2, Ohio.

Robert Ernst, manager of **Omni Products Corp.** and **Omni International Corp.**, 460 Fourth Ave., New York 16, N. Y., is on an extended trip through Europe, visiting officers of his company, agents, and customers. A major portion of Mr. Ernst's time and effort will be devoted to the study of market possibilities for reinforced plastics and the presentation of information on reinforced plastics to European firms.

MEETINGS

Oct. 8-9 — Society of the Plastics Industry, New England Section Meeting, Equinox House, Manchester, Vt.

Oct. 26-31—Annual Paint Industries Show, Chalfonte-Haddon Hall, Atlantic City, N. J.

Oct. 27 — Association of Consulting Chemists and Chemical Engineers, Inc., Annual Meeting and 25th Anniversary, Hotel Belmont Plaza, New York, N. Y.

Nov. 9-12 — Refrigeration Equipment Manufacturers Association, Refrigeration and Air Conditioning Exposition, Public Auditorium, Cleveland, Ohio.

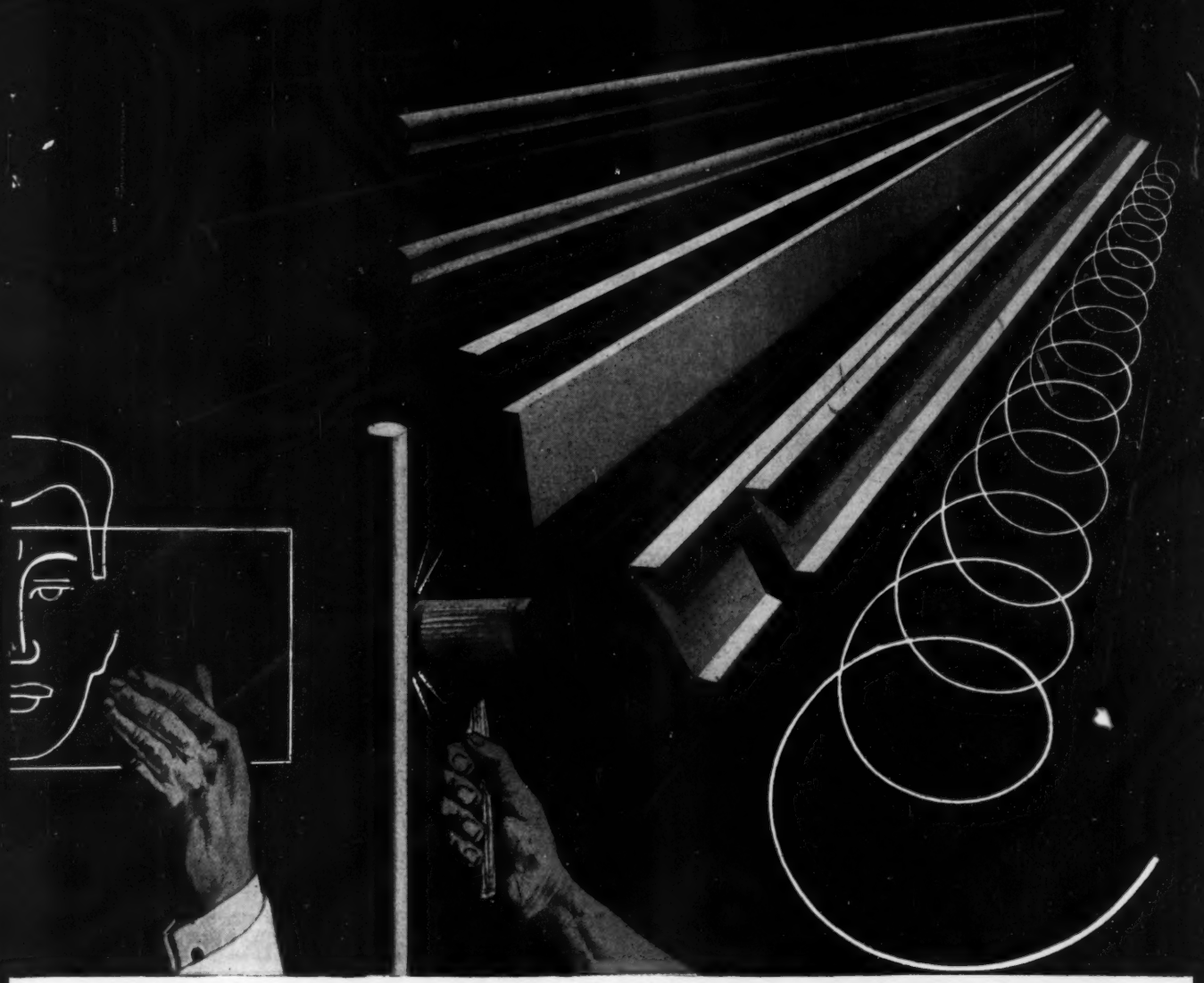
Nov. 30-Dec. 5 — Chemical Industries Exposition, Commercial Museum and Convention Hall, Philadelphia, Pa.

Dec. 3-4 — Society of the Plastics Industry, Fifth Film, Sheeting, and Coated Fabrics Div. Conference, Commodore Hotel, New York, N. Y.

Dec. 13-16 — American Institute of Chemical Engineers, Annual Meeting, Hotel Jefferson, St. Louis, Mo.

S. P. E. Meeting

Oct. 14 — Thomas Harris, manager of Cargo Sales for American Airlines, will address the Newark Section on "The Potential Market of Plastics."



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FOR SALE: 1—Jeffrey Swing Hammer Shredder with a 30 H.P. motor and controls. Can be used to pulverize any material. One 2 oz. Moslo Injection Molding Machine. Both machines are in excellent condition. ROART CO., 830 Monroe St., Hoboken, N. J.

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FOR SALE: Rubber and Plastic Equipment. Farrell 16" x 48", 15" x 36" and 6" x 12", 2 roll rubber mills. Other sizes up to 84". New Seco 6" x 12" and 6" x 16" Lab. Mixing Mills and Calenders. Rubber & Plastic Extruders. Stokes #280, 4" diam. Preform Machine. W.S. 300 ton downstroke Hydr. Press, 30" x 30" Platens self contained. 350 ton 22" x 24". New Loomis 340 ton & 50 ton Hydr. Presses. 24" x 56" Platens. 200 ton Brunswick 21" x 21" Platens, 14" Ram, Record Presses. W.S. 150 ton 30" x 60". 100 ton 24" x 24". Elmes 75 ton 30" x 36". Also presses Lab. to 2000 tons from 12" x 12" to 48" x 48". Hydr. Oil Pumps. Gould 75 HP motor Dr. 2 stage Centrif. Pump. 250# W.P. W.S. 4 Plgr. High and Low Pressure Hydr. Pump. HPM 5 GPM 2700 lbs. Elmes Hor. 4 Plgr. 4500 lbs. and 5500 lbs. Hydr. Accumulators. Stokes Automatic Molding Presses. Rotary & Single Punch Preform Tablet Machines ½" to 4". Injection Molding Machines 1 oz. to 32 oz. Baker Perkins Jacketed Mixers 100, 50, and 9 gal. Plastic Grinders. Heavy duty mixers, grinders, pulverizers, gas boilers, etc. Partial listing. We buy your surplus machinery. STEIN EQUIPMENT CO., 107-8th Street. Brooklyn 15, N.Y. STerling 8-1944.

FOR SALE: 1—6"x12" Lab. Roller Mill; 1—Baker Perkins Banbury type 10 gal. Mixer, with pressure cover, m.d.; 4 Bolling 18"x18" 5-opening Hydraulic Presses; 1—HPM 4-oz. Injection Molding Machine; 2—Ball & Jewell Rotary Cutters; 1—100 gal. Patterson Kneadermaster S/S Mixer; 1—Eureka Rotary Cutter; 1—500 gal. Patterson Reaction jack. agit. Resin Kettles; 7—Dry Mixing Blenders, up to 11,000#; 1—Day Roball 82 Sifters, 40" x 120" screens; 2—Rotex #12, 20"x37" screens; 1—Retex 30"x48" Sifter; 3—Mikro Pulverizers 2TH, 3TH, 2DH. Also Grinders, Extruders, Compression and Injection Molding Presses, etc. Send us your Inquiries. Advise us what you have for sale. CONSOLIDATED PRODUCTS CO. INC., 13-14 Park Row, New York 38, N.Y. BArclay 7-0600.

FOR SALE: Reinforced Plastics Press 54"x144" Pl. Injection Presses: 32 oz., 24 oz., 12 oz., 4 oz. Reeds, 4 oz., 9 oz., HPM, 8 oz., 16 oz. Lesters, 6 oz. Watson, 1 oz. VanDorn, 4 oz. Makray. Extruders: 1½" NRM, 1—¼" MPM w. crosh. Scrapgrinders. Ovens. Compress. Presses. 1—Stokes automatic 50 tons 235A. Preformpresses: Colton 5½ T, Stokes 280C, Kux 25.42" Slitting & Rewind mach. 1—Industrial Ovens' complete Wire Coating & Drying unit. 3 HP Gasboilers. List your equipment with me. JUSTIN ZENNER, 823 Waveland Ave., Chicago 13, Ill.

WE HANDLE HYDRAULIC PRESSES, pumps and power units of all sizes. Write us your requirements and we will try to help you. We find it impossible to list our equipment in this classified column due to the fact that the equipment is sold before ad is published. For those who seek action look in the New York Times under the Machinery and Tool Column for our regular Sunday Special. HYDRAULIC SAL-PRESS, INC., 386-90 Warren Street, Brooklyn 2, N. Y. MAin 4-7847.

FOR SALE: POLYVINYL ACETATE UNIT, capacity 1000# per hour. Includes, 500 gal. s/s Reaction Kettle with Condensers and Xpl motor; 6' dia. x 15' long s/s, d.h. Rotary Resin Dryer; solid bowl type, all s/s Centrifuge, 30" x40", m.d.; 3—s/s Tanks, 500 gal., 250 gal.; 3—s/s Pumps with Xpl motors. Equipment is NEW, entirely of 316 stainless. Priced at fraction of new cost. Drawings available. CONSOLIDATED PRODUCTS CO. INC., 13-14 Park Row, New York 38, N. Y. BArclay 7-0600.

FOR SALE: 1948 two ounce Fellows injection molding machine with factory installed booster. Press includes one extra $900.00 heating cylinder and one Eagle Signal Timer. Only reason for selling is to make room for larger equipment. Press is in perfect condition and can be seen in operation. Write, phone or wire—ADAMS PLASTIC PRODUCTS, Box 926, Cincinnati, Ohio.

STOKES ROTARY PELLET PRESSES (5): 16-punch RD-3 and 15-punch RDS-3 (one with slotted head); (2) Kux model 25 Presses 21 and 25 punch. Ball & Jewell #1½ stainless steel rotary cutter. Mikro Pulverizers #1-SH, #1-SI, #2-TH, #2-SI & 24". Large stock steel and stainless tanks and kettles. PERRY EQUIPMENT CORP., 1429 N. 6th St., Phila. 22, Pa.

FOR SALE: 16 oz. Injection Molding Machine approx. 2½ years old. Reliable company desires to standardize equipment. Machine in excellent operating condition. Popular make. Would consider trade for same size in make we desire. For information write or call D. W. HAINES, 142 Parsons Avenue, Columbus 15, Ohio. MA-7401.

BUSINESS OPPORTUNITY: Want to cash in on the plastics industry's newest money maker, VACUUM-FORMING? We offer one "doublebed" type press (60"x40"x8" draw) complete with vacuum system, very slightly used. Will consider offer of reliable purchaser with satisfactory references to pay out of operating income. NOSCO PLASTICS, Box #269, Erie, Pennsylvania.

FOR SALE: 8 Singer Electronic Bonding Machines. In excellent condition. 3 Bonding Machines available with conveyors. 5 without. Splendid opportunity for substantial savings on practically new equipment. Reply Box 1004, Modern Plastics.

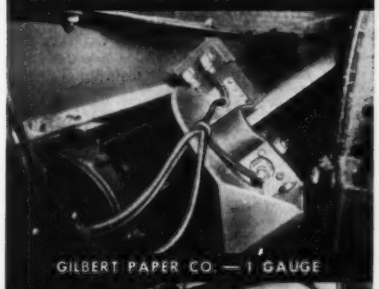
FOR SALE: 5 Compression molding presses, 100 to 600 tons, 2 Ball & Jewell 1 HP rotary cutters, 2—3000# jacketed ribbon blenders, also injection molding machines, preform presses, extruders, mills, etc. Send us your inquiries. CHEMICAL & PROCESS MACHINERY CORP., 146-148 Grand Street, NYC 13, Tel. WO 4-8130.

FOR SALE: One ½" diameter electrically heated M.P.M. extruder less than one year old. Used approximately 150 hours in Research laboratory. Complete with all accessories. Reply Box No. 1026, Modern Plastics.

TWO 10D-12 oz. Reed Prentice injection molding machines new in 1950, excellent condition, now operating. Will consider financing to responsible party. JIM ROBBINS COMPANY, Stephenson Hwy. at 14 Mile Road, Royal Oak, Michigan.

(*Continued on page 252*)

STRATHMORE PAPER CO. — 2 GAUGES


GILBERT PAPER CO. — 1 GAUGE

HOOD RUBBER CO. — 5 GAUGES

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do as the representative firms shown here have done and install Tracerlab Beta Gauges. The highly accurate, non-contacting measurements they provide are instrumental in cutting raw material costs, improving quality, and providing continuous measurements never before possible on many materials and on numerous coating applications.

Write for booklet PP-1 which describes in detail the fundamentals of beta gauging.

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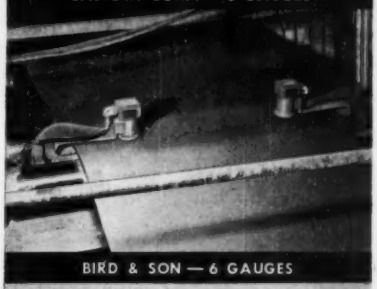
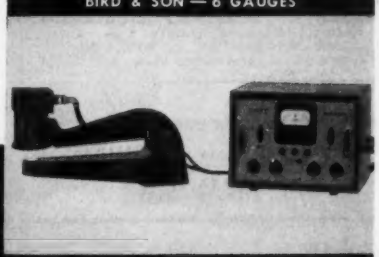

BIRD & SON — 6 GAUGES


BG-1 ABSORPTION GAUGE — $3,300.00

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211 Powers Bldg. Rochester 4, N. Y. Tel. BAker 8701
P.O. Box 5604 Phila. 29, Pa. Tel. Victor 4-8679

CLASSIFIED ADVERTISING

(*Continued from page 250*)

FOR SALE: ONE 1949 Stokes Model 235-A-50 automatic press. Priced, as depreciated, $5,370. This machine is in excellent condition and can be seen in operation. WAHL CLIPPER CORP., Sterling, Illinois.

FOR SALE: Steam boiler, Livingston Speedy-lectric, Series 11/2, Model 700 (249 PSI). Used 40 hrs. Complete with fittings, and high pressure hose. BRIGHTON PLASTICS COMPANY, 157 York Street, Rochester 11, N. Y. GEnesee 2592.

INJECTION MOLDING MACHINES For SALE: 3 ounce Fellows Automatic Injection Molding Machine—Used only 8 months—Excellent condition, $9,000.00. 9 ounce HPM—1953 Model—Excellent condition, $19,250.00. Reply Box 1019, Modern Plastics.

VACUUM PLATING MACHINE 4' National Research, rotary type. Offers. ACME MACHINERY & MFG. CO., 102 Grove Street, Worcester, Mass. Tel. 7-7747.

MACHINERY and EQUIPMENT WANTED

WANTED: Banbury Mixers, Heavy Duty mixers, Calenders, Rubber Rolls & Mixers, Extruders, Grinders & Cutters, Hydraulic Equipment, Rotary and Vacuum Shelf Dryers, Injection Molding Machines. Will consider an operating or shut down plant. P. O. Box 1351, Church Street, New York 8, N. Y.

WANTED: Laboratory 2 roll mill, 6"x12", suitable for operation at 350 degrees F. Must be in running condition. Please provide full particulars, including price. Reply Box 1013, Modern Plastics.

WANTED: 16-02 H.P.M. injection molding machines with or without preplasticizers. Late models. Must be in good condition. FRAWLEY MANUFACTURING CORPORATION, Salinas, Puerto Rico.

WANTED: Plant or Machinery including Rubber Mills, Hydraulic presses, Sturdy mixers, Calenders, Banbury mixers, Pulverizers, Grinders, Rotary cutters, Extruders, Screens, Injection Molding machines, Dryers. CONSOLIDATED PRODUCTS CO. INC., 13-14 Park Row, New York 38, N. Y. BArclay 7-0600.

WANTED: Stokes Standard 150-300 ton Presses, large ram presses from 16" up. large Preform Presses 1½" up. Universal Hydraulic Machinery Co. Inc., 285 Hudson St., New York 13, N. Y.

WANTED: Plastic injection moulding machines. Get our offer before you sell. ACME MACHINERY & MFG. CO., 102 Grove St., Worcester, Mass.

WANTED: Plastic injection moulding machine 12 ounces or more, grinder and tumbler. Rush Industries Inc., 829 N. Milwaukee Ave., Chicago 22, Illinois. Taylor 9-9600.

MATERIALS FOR SALE

SCRAP P.V.C. and other thermoplastics in all forms. MICHAEL S. STEVENS, MERCHANTS, Keswick Works, Keswick Road, London, S.W. 15, England.

FOR SALE: 960 sheets .030 plastacele (DuPont HHCC14). Transparent green. Write: ROSS, 4722 Broadway, Kansas City, Missouri.

MATERIALS WANTED

WE NEED YOUR SURPLUS
Molding Powders & Sheet Scrap
Solicit our Current Quotations on
Polystyrene—Hi-Impact—Rigid Vinyl
CLAUDE P. BAMBERGER, INC.
152 Centre Street B'klyn 31, N. Y.
Tel: Main 5-5553
Not connected with any other firm of similar name.

WE ARE ALWAYS IN THE MARKET FOR THERMOPLASTIC SCRAP AND REJECTS OF ALL KINDS. Also surplus or obsolete lots of reprocessed and virgin materials purchased. Highest prices paid. Custom grinding and compounding to your specifications. PLASTIC MATERIALS, INC., 589 Main Street, Westbury, L.I., N.Y. DIAL—WEstbury 7-7124.

WANTED: Plastic Scrap, Rigid Vinyl, Cellulose Acetate, Polystyrene, Polyethylene, Butyrate, Custom grinding, magnetizing, compounding, and straining of contaminated plastics. FRANKLIN JEFFREY CORPORATION, 2004 McDonald Avenue, Brooklyn, N. Y., ES 5-7943.

WANTED: PLASTIC SCRAP OR REJECTS in any form. Also surplus and obsolete lots of virgin molding powders. We also custom reprocess your own scrap. A. BAMBERGER CORP., 703 Bedford Ave., Brooklyn 6, N. Y. Telephone: MAin 5-7450.

WANTED: PLASTIC SCRAP or REJECTS in any form: Cellulose Acetate, Butyrate, Polyethylene, Polystyrene, Vinyl, Acrylic, Ethyl Cellulose. Reply Box 1007, Modern Plastics.

WE CAN USE UP TO 50,000# reground Clear or Amber Ethyl Cellulose. Please forward samples, advising poundage, and lowest price. Can also use all types of nitrocellulose scrap. Reply Box 1017, Modern Plastics.

WANTED: VIRGIN POLYETHYLENE Alathon 1 & 10; DE 2400; DYNH 3. Need continuous supplies. AMERICAN VINYL CORP., 38-01 23rd Ave., L.I.C. 5, N.Y. AS 4-1768.

WANTED: SURPLUS UREA molding powder. Reply Box 1009, Modern Plastics.

MOLDS FOR SALE

FOR SALE AT 40% of present cost, efficient Molds and Production Fixtures for six popular New Toy Items. Sales market barely exploited on all items, some inventory of component parts available, will consider installment contract with proper parties. Information and samples on request. Write P.O. BOX 25, Roosevelt Station, Dayton 7, Ohio.

FOR SALE: 1—4 cavity baby brush mould. 1—brush and mirror mould. 1—cover mould for miniature piano cigarette box. ROART CO., 830 Monroe St., Hoboken, N. J., HOboken 2-2020, 2021.

INJECTION MOLDS For BUTYRATE DOLL HEADS. Reasonable. HORSMAN DOLLS, INC. P.O. Box 1890, Trenton, N. J.

MOLDS WANTED

MOLD WANTED for injection molding. We will buy one mold or a complete line or series of molds for finished resalenble items. Housewares, toys, novelties, etc. Will also buy molds for industrial parts such as handles, knobs, drawer pulls, gears. All items for resale in U. S. A. Send detailed information to VICTORY MANUFACTURING COMPANY, 1722 W. Arcade Place, Chicago 12, Illinois.

PLASTIC MEN. Injection Mold for plastic figures approximately four inches in height. Western or Space men. Send samples, price, and number of cavities plus molding cycle. U. S. PLASTIC COMPANY, 2570 E. Walnut Street, Pasadena 8, California.

BRUSH MOLDS & BRUSH MACHINERY, injection molds for ladies, mens, military, nail, toothbrushes, etc. Send particulars & samples. Box 382, REALSERVICE, 110 West 34th, New York, N. Y.

PLANTS FOR SALE

FOR SALE
Complete wood flour mill. Capacity 10 tons per 24 hours, using nearby supply of pine and poplar. For further particulars, reply Box 1008, Modern Plastics.

FOR SALE: Complete Compression Molding Plant plus a 2 ounce injection molding press. May be seen in operation—many extras—low cash figure—must be moved from premises. Please reply Box 1029, Modern Plastics or phone WAlker 5-0218.

PLANTS WANTED

PLASTICS PLANTS WANTED. Going Business, Volume $300,000 to $3,000,000: Consumer-Proprietory or Industrial Products: We represent a Leading Nat'l. Corporation: Seeking Diversification & Expansion into new fields and Territories. Sizeable Investments Preferred: Name of Company on request: Competent and Confidential Dealings. GOLDEN INDUSTRIAL AGENCY, 2189 Gr. Concourse, N. Y. 53.

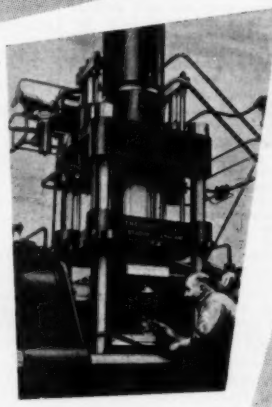
HELP WANTED

WANTED—WORKS MANAGER—Large midwest company who has been buying its injection molded fabrications now intends to install own plastics molding plant. Wants man to take complete charge of injection molding program which calls for growth to 4 to 6-machine plant within two years. Must be familiar with industrial part design, die design and have a thorough knowledge of production. Ability to handle labor is very important. This is an opportunity for the right man to join a soundly-financed, expanding company on a lifetime basis. Salary commensurate with ability and experience. Our employees know of this advertisement. If you're interested in a lifetime opportunity, write a letter giving complete details to Box 1022, Modern Plastics.

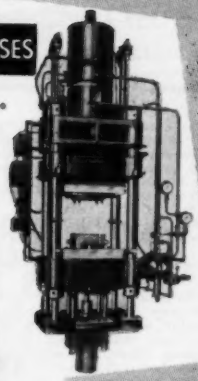
(*Continued on page 254*)

Excellence of Design to meet Specialist Requirements

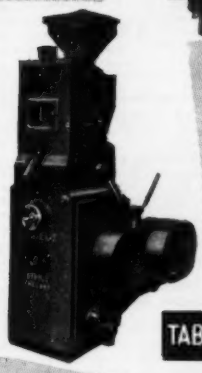
Illustrated are three of the machines which have made the name of T. H. & J. Daniels familiar to the Plastics industry throughout the world. They are the finest of their type and manufacturers are invited to write for illustrated Catalogue of these and other productions of the firm.



TRANSFER PRESSES



SIDE RAM PRESSES



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Models for various column and gib type drill presses.

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- ★ Less tap breakage.
- ★ Quickly repays its low cost.
- ★ Taps metals and plastics—from #0 to ⅛".

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Our technicians will gladly aid in creating industrial fabrics to your specification. We solicit your inquiries.

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62 WORTH STREET / NEW YORK 13

CLASSIFIED ADVERTISING

(Continued from page 252)

SALESMAN—Some practical experience in plastics, for missionary and development work on sheets and films in Midwestern area. Opportunity to grow with new division of well established, highly regarded leader in field. Write in confidence with full particulars to CAMPCO DIVISION, CHICAGO MOLDED PRODUCTS CORPORATION, 2717 North Normandy Avenue, Chicago 35, Illinois.

MOLD DESIGNER NEEDED—Large engineering company in midwest in need of designer familiar with the design of matched molds and half molds used in reinforced plastics. Include complete discussion of experience and salary requirements in first letter. Reply Box 1001, Modern Plastics.

CHEMISTS and CHEMICAL ENGINEERS
Why you should consider a career at Celanese.
One of the country's most research-minded organizations, Celanese provides an excellent working environment.
The major expansion of its modern research laboratories (located in Summit, New Jersey, a pleasant residential community within 30 minutes of metropolitan New York City) offers a challenge to the following:

ORGANIC CHEMISTS
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2. PhD, 2-5 years experience in process engineering.

CHEMISTS or ChE'S
1. MS, 3-5 years experience in coatings, adhesives and inks for Applications Research.
2. BS, 3-5 years experience in reinforced plastics, for Applications Research.

These are permanent positions providing salaries based on experience and ability. Promotional opportunities are excellent.
Please submit resume, including initial salary requirements to: Mr. J. A. Berg, Head—Personnel Administration.
CELANESE CORPORATION OF AMERICA
Summit, New Jersey

SUBSTANTIAL NEW YORK COMPANY about to enter Plastic film products field seeks man to design and promote suitable items. Write giving background, personal information, and salary desired. Reply Box 1016, Modern Plastics.

POSITION OPEN FOR AN EXPERIENCED PLASTICS ENGINEER to set up and develop a complete line of plastic pipe. Includes selection of equipment, operating manufacturing department, technical development, and training of sales organization. Apply by letter stating background and salary requirements. Reply Box 1005, Modern Plastics.

ASSISTANT PLANT MANAGER for leading film and sheeting plant—thoroughly experienced—excellent future. State experience, age, salary, and full details. Reply Box 1028, Modern Plastics.

TECHNICAL SALESMEN WANTED—Position open with large Midwest color manufacturer to head up color sales to the plastics and rubber industries. Must have some experience in the use of color in the plastics and rubber fields. Excellent opportunity for advancement in a new department. Reply Box 1010, Modern Plastics.

ENGINEER-FOREMAN to assume responsibility for experimental, tooling and production of reinforced plastic product. Must have thorough knowledge of polyester-fiberglass laminating techniques. Good opportunity in an established firm in a southwestern state. Submit resume of work experience and salary expected to Box 1002, Modern Plastics.

CHEMIST, thoroughly experienced in treating with melamine and phenolic resins for high pressure laminates. Excellent position with expanding Eastern company. Send full resume. All replies treated in strict confidence. Reply Box 1006, Modern Plastics.

ENGINEER OR ENGINEERING DRAFTSMAN capable of designing and detailing plastic injection molds and estimating mold and production part costs. Progressive company, which is leader in its field, is located in Northern New Jersey and doing volume of about one and one half million dollars in a specialized industrial field. An outstanding opportunity for a man that wants to grow with a sound growing company. In applying, please state age, education, experience and salary requirement. Reply Box 1024, Modern Plastics.

CHEMICAL ENGINEERS AND CHEMISTS. Several attractive openings are available in Engineering, Production and Research Departments of a rapidly expanding synthetic resin plant located in New England. Excellent opportunities for men with initiative and ambition. Send details of education, experience and salary required. All replies held in strict confidence. Reply Box 1015, Modern Plastics.

WANTED: PLASTICS ENGINEER experienced in reinforced fibreglass. To take complete charge of new operation. Plant located in a southern seaport city. Replies held in strict confidence. Reply Box 1014, Modern Plastics.

CHEMICAL ENGINEER—An established Eastern manufacturer of plastic process machinery requires a young graduate chemical engineer for Technical Service. Some experience in process work desirable. Excellent opportunity for a man who likes some travel and meeting people. Please furnish complete resume and salary desired. Reply Box 1027, Modern Plastics.

PLASTIC MOLD ENGINEER AND DESIGNER. Experience required in designing injection molds and estimating production and mold costs. Expanding business, new products, modern plant and techniques offer unusual future. Salary in line with experience and ability. Plant located in Metropolitan New York. State age, experience, etc. Reply Box 1031 Modern Plastics.

SITUATIONS WANTED

PLASTIC FILM ENGINEER—Chemical Engineer, 27, with production experience in polyethylene film extrusion, flat and tubular. Supervised the converting of layflat tubing into bags. Familiar with techniques of treating film to improve its printability. Knowledge of printing and embossing on polyethylene and vinyl film, and extrusion laminating. Interested in production or development. Family. Will relocate. Reply Box 1020, Modern Plastics.

POLYESTER ENGINEER—Mechanical Engineer has knowledge of polyester resins and techniques, candidate for M.S. in Mechanical Engineering, Master's thesis "Glass Reinforced Polyesters," college year of Business Administration studies, completed 4 year machinist apprenticeship, experienced in production engineering and scheduling, age 25, married. Desires position with progressive company, which offers excellent advancement possibilities. Reply Box 1012, Modern Plastics.

SALES ENGINEER, with plastics experience and extensive industrial following in southern Ohio and Indiana and Louisville, Kentucky desires association with custom moulder and decorator. Can offer immediate opportunity to quote on large number of high volume items required by appliance manufacturers in this area. Please do not reply if not prepared to handle considerable volume from this territory. Reply Box 1018, Modern Plastics.

CHEMICAL ENGINEER — B.Ch.E. degree. Would like to get back into plastics industry after being away for nine months. Previous experience includes production supervision, equipment set up and design, and personnel training in film extrusion and converting. Am interested in injection molding or extrusion fields. Would start from the bottom for an opportune position. Family is willing to relocate. Reply Box 1021, Modern Plastics.

GENERAL MANAGER: An Engineer who wants to roll up his sleeves and build an organization. Ten years of proprietary and custom molding experience covering Sales and supervision of every phase of Injection Molding, Product Design, Estimating, Mold building, Assembly methods, Standards, Decorating, and Packaging. Looking for an opportunity with a medium sized proprietary or custom molding plant. Willing to relocate. Reply Box 1023, Modern Plastics.

SALES AGENTS WANTED

PROMINENT, WELL KNOWN EASTERN CUSTOM EXTRUDER seeks representation in industrial territories outside of N. Y. Prefer men now selling custom moldings to which they can add additional line. Technical knowledge of plastics essential. Please submit full details. Reply Box 1030, Modern Plastics.

PLASTICS MANUFACTURER'S REPRESENTATIVE—Large East Coast plastics concern seeks representation in upper New York State area for sale of plastic copolymer sheet stock and custom molded products. Reply Box 1025, Modern Plastics.

SALES REPRESENTATIVE WANTED—LIQUID TYPE PHENOLIC AND UREA RESINS. (Solid Phenolics Also Available But Have Full Schedule) Will make commission or other suitable arrangement. Reply Box 1011, Modern Plastics.

MISCELLANEOUS

NOTICE
Young Manufacturers' Agent Needs Reputable Company to represent for Midwestern area sales. Engineering background.
T. COVINGTON
7530 N. Sheridan Rd. Chicago 26, Ill.

FOR SALE: ACETATE, white, ivory, pink pastels, red, blue and green, at 28¢ per pound, F.O.B. New York, regular supply. Odd colors 23¢.
16 OUNCE IMPCO Injection Machine, without press, $5000.00.
WANTED: a 350 ton Toggle Press.
PEERLESS CHEMICAL CORP.
181 Greene Street, N. Y. C. 12.

SPACE FOR RENT—Loft units of from 5,000 to 15,000 feet per floor, fully heated, sprinklered, watchman service, central Connecticut. Write or phone for appointment. HARTFORD SPINNING INC., Unionville, Connecticut.

INTERESTED IN PURCHASING a going plastic moulding business. Must be well established, good earnings record. Preferable location in midwest. Cash deal. Reply Box 1003, Modern Plastics.

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Minimum Ratio 1:1.5;
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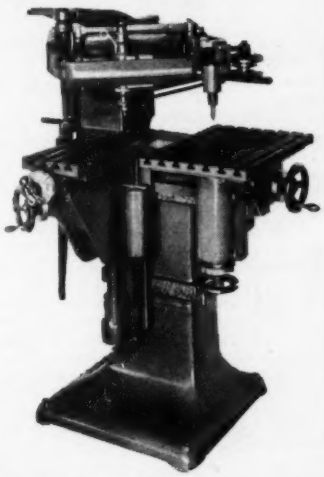

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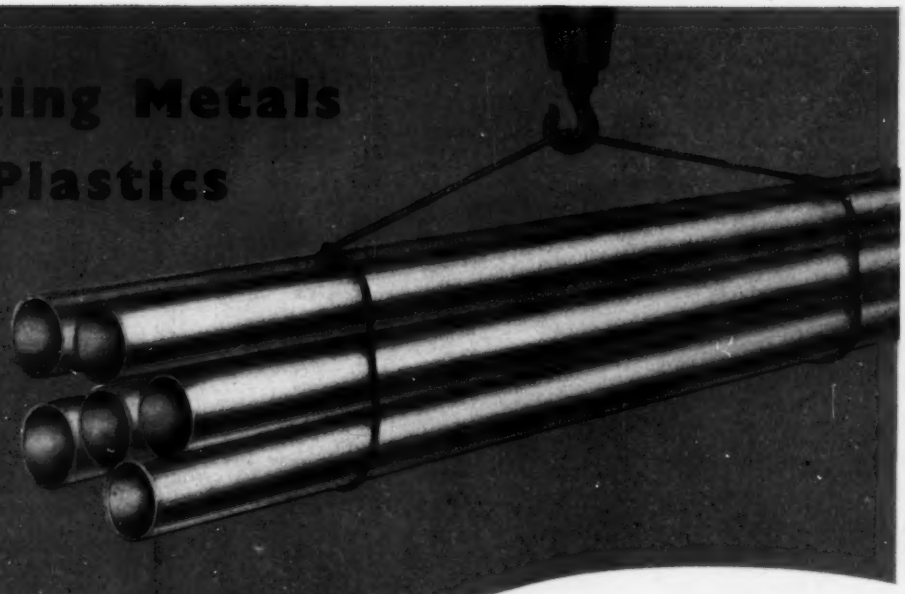

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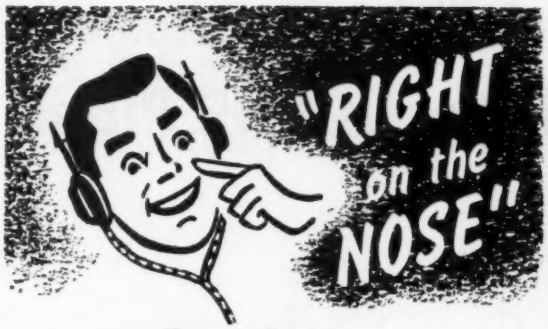

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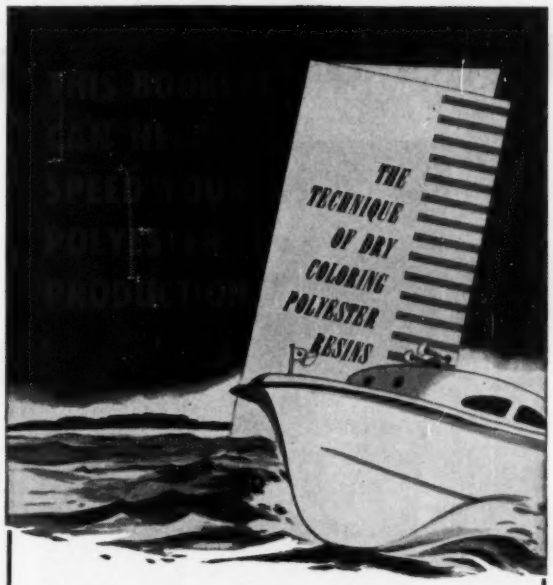

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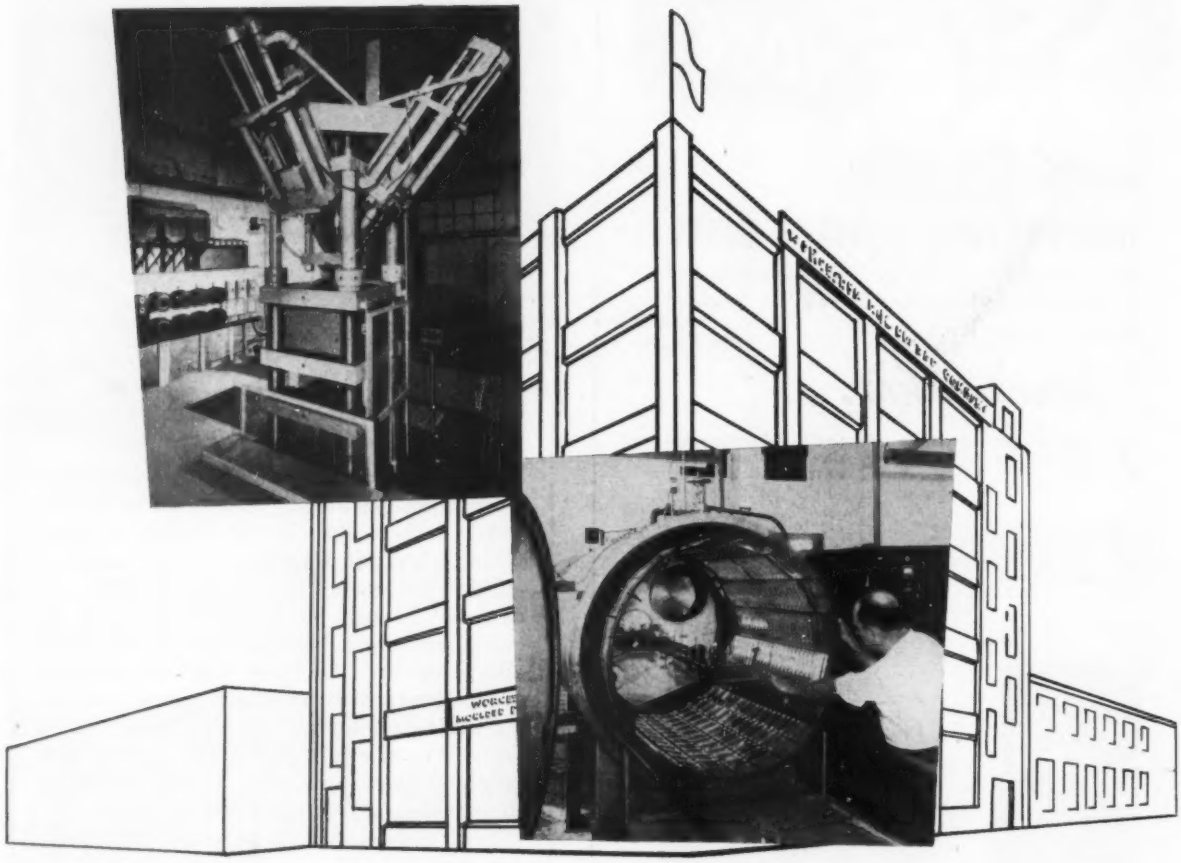

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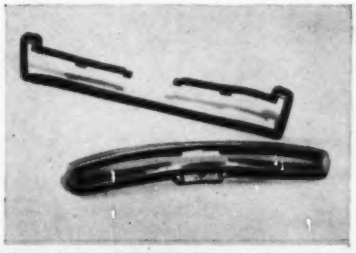

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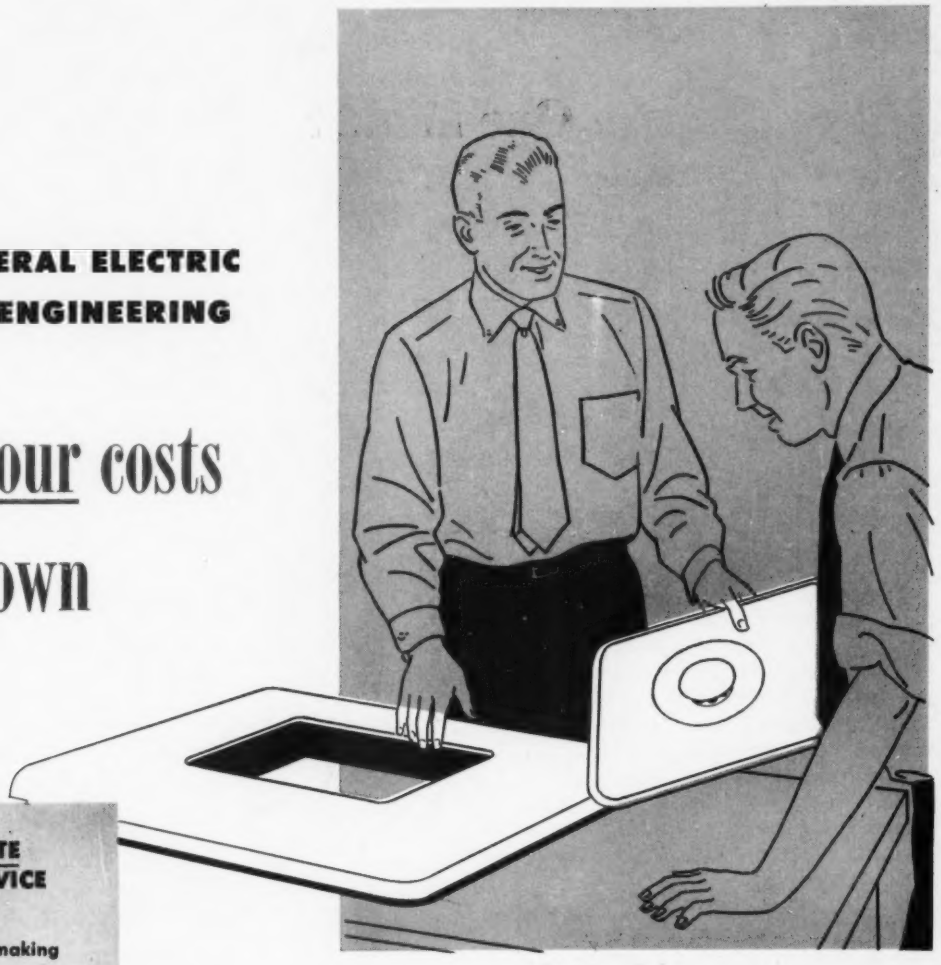

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